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PATENT ABSTRACTS OF JAPAN

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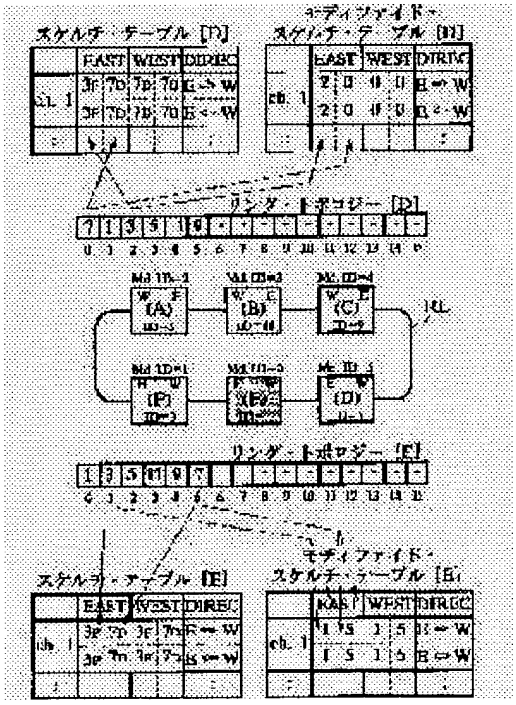
(54) RING TRANSMISSION SYSTEM AND SQUELCH METHOD FOR THE SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To attain squelch processing at a high speed with respect to the ring transmission system of the BLSR(bidirectional line switched ring) system and its squelch method.

SOLUTION: In the ring transmission system of the BLSR system where nodes (A)-(F) are connected by a ring transmission line RL, the nodes (A)-(F) have modified squelch tables [A]-[F] and a squelch judgement section. A ring topology is built up by sending a ring topology frame, into which an ID of each node is inserted, and a modified node TD in which each node sets its own node as a head node and its own node is set to have a reference value such as 0 and the connection sequence is made in ascending order is provided to each node, the modified squelch table is formed by modified node IDs and squelch is judged by the comparison between the modified node ID to which a signal is not reached on the occurrence of a fault and the modified node ID of the modified squelch table.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the squelch approach of the ring transmission system of a bidirectional line switch ring method, and this system. The system which connected two or more nodes according to the ring transmission line can be divided roughly into a unidirectional pass switch ring (UPSR;Uni-directional Path Switched Ring) method and a bidirectional line switch ring (BLSR;Bi-directional Line SwitchedRing) method.
[0002] Since it becomes usable between the nodes from which the latter bidirectional line switch ring method differs the same channel as compared with the former unidirectional pass switch ring method, there is an advantage which can enlarge circuit capacity. In this bidirectional line switch ring method, if it will be in the condition that the failure occurred in two or more places, and the ring transmission line was divided, the signal which cannot reach the object node occurs and that signal may be transmitted to other nodes by the loop back for failure relief. In that case, since it becomes the communication link between the mistaken nodes, the squelch (squelch) which permutes and sends out the signal which cannot reach the object node to a pass alarm-display signal (P-AIS;Path Alarm Indication Signal) is performed. It is requested that it is efficient and this squelch is performed at high speed.
[0003]
[Description of the Prior Art] Drawing 31 is the relief explanatory view of a failure, a unidirectional pass switch ring (it calls for short Following UPSR) method sends out the same signal to the WE side of the direction of node D by channel ch.1 the EW side of the direction of a node (B) from a node (C), as shown in (a), and a node (A) carries out selection reception of the signal of channel ch.1 with the pass switch PathSW. As it follows, for example, is shown in (b), even if a failure occurs between a node (A) and (B), since a node (A) can carry out selection reception of the signal of channel ch.1 which minded the node (D) with the pass switch PathSW, it can continue the communication link between a node (C) and (A).
[0004] Moreover, a node (C) can send out the signal to a node (A) by channel ch.1 for example, by the side of EW, and a bidirectional line switch ring (it calls for short Following BLSR) method can send out the signal to a node (D) by channel ch.1 by the side of WE, as shown in (c), and a node (D) can send out the signal to a node (A) by channel ch.1 by the side of WE. That is, using identitas channel ch.1, the communication link between a node (D) and (A) is attained between a node (C) and (D) between a node (C) and (A), and circuit capacity can be enlarged as compared with a UPSR method.
[0005] If a failure occurs between a node (A) and (B) in this BLSR method as shown in (d) It is what is relieved with an APS (Automatic Protection Switch) protocol. In a node (B) It acts to channel ch.25 of the reserved circuit shown with a thin line as the loop back of channel ch.1. For example, in a node (A) By changing channel ch.25 of a reserved circuit to channel ch.1 In a node (B), change the signal sent out to channel ch.1 from the node (C) to channel ch.25 of a reserved circuit, and it is turned up. a node (A) -- setting -- channel ch.25 of a reserved circuit -- present -- business -- by changing to channel ch.1 of a circuit, the communication link between a channel (C) and (A) is continuable. In addition, since it does not pass through between a node (A) and (B) between a node (C) and (D) and between a node (D) and (A), a communication link is performed by channel ch.1, respectively.
[0006] drawing 32 -- the explanatory view of an APS protocol -- it is -- WK -- present -- business -- the node (A) which the circuit and PT showed the reserved circuit, and the failure generated them between a node (A) and (B), and detected the alarm turns into a switching node, and sends out the request (SF-RING;Signal Failure Ring) which shows the both sides of Short Pass and a long pass a transmission-line

failure to the node (B) of an opposite station. If the node (D) which received the request of a long pass, and (C) identify the destination (B) of a request and it recognizes that it is not addressing to a self-node, they will be in the condition of a full passthrough and will pass K1, K2 byte, and a reserved-circuit (protection) channel.

[0007] moreover, the node (B) which received Short Pass's request -- a switching node -- becoming -- Short Pass -- a reverse request (RR-RING;ReverseRepuest Ring) -- moreover, the same request (SF-RING) as the received request is sent out to a long pass. In the case of a transmission-line failure, a bridge and a switch are simultaneously performed in the phase which received the request from a long pass. traffic with the same bridge -- present -- expressing business and the condition of sending out to a spare channel, a switch expresses the condition of choosing TORAFUIIKU from a reserve channel.

[0008] therefore, according to failure generating between a node (B) and (A), by the node (A), the bridge which sends out the signal to a node (C) to a reserved circuit PT is formed, and this reserved circuit PT goes to a node (C) from a node (B) in a node (B) -- present -- business -- the switch sent out to Circuit WK is formed. moreover -- a node (B) -- the node (A) from a node (C) -- present -- business -- the bridge which turns up the signal by Circuit WK to a reserved circuit PT -- forming -- a node (A) -- from this reserved circuit PT -- present -- business -- the switch changed to a circuit is performed. Therefore, the communication link between a node (A) and (C) is continued.

[0009] Drawing 33 is a header and K1, and a K2 byte explanatory view. The frame structure of STM-0 (52Mbps) of 9 line x90 line, VC-3 of the virtual container of nine line x85 train are shown. The section over head SOH of nine line x3 STM-0 frame train Frame synchronization A1 and A2, STM-1 identification number C1, and the error monitor B1, Each cutting tool of the voice arrangement E1, the failure specification F1, data communication D1-D3, pointers (AU PRT) H1-H3, error monitor B-2, the objects K1 and K2 for APS, data communication D4-D12, reserves Z1 and Z2, and the voice arrangement E2 is included.

[0010] Moreover, as for the pass over head POH, VC-3 are multiplexed by the pay load of nine line x87 train of STM-0 including each cutting tool of the pass flow monitor J1, the pass error monitor B3, the pass information discernment C2, error indication G1, the channel F2 for maintenance, the discernment H4 of a multi-framing number, and reserves Z3-Z5. Moreover, STM-1 (156Mbps) is constituted by 3 multiplexing of STM-0.

[0011] Moreover, K1 byte of the section over head SOH It becomes the bit [1-4th] request from the bit [5-8th] distant office ID (identification number of a K1 byte destination node). Moreover, K2 byte The bit [1-4th] local station ID (identification number of a request generating node) It is what consists of a bit which shows bit [5th] the Short Pass request ("0") or a long pass request ("1"), and the bit [6-8th] status. A K1 byte request expresses SF-RING above-mentioned in "1011", and RR-RING above-mentioned in "0001", and expresses those without a request with "0000." Moreover, the K2 byte status is AIS;Alarm by "111". Indication Signal is expressed. Moreover, also in STS-1 signal (52Mbps) of SONET, it is the same.

[0012] Drawing 34 is a squelch actuation explanatory view. As mentioned above Between a node (A) and (C), While communicating by channel ch.1 between a node (C) and (D) between a node (A) and (D), respectively, the squelch table of channel ch.1 response of each node Store the transmitting node (node which inserts a signal), and the receiving node (node which drops a signal) for every sending-out direction of a signal, for example, the squelch table in a node (C) The node identification number of the receiving node (A) and transmitting node (C) which are sent out to a node (B) side, and the receiving node (D) and transmitting node (C) which are sent out to a node (D) side is stored. That is, according to the signal sending-out direction, a node identification number is stored in the array of a transmitting node and a receiving node.

[0013] If a failure occurs between a node (A) and (B) and between a node (A) and (D) a node (A) is isolated -- ******** -- moreover, a node (B) -- setting -- present -- business -- channel ch.1 of a circuit being turned up to channel ch.25 of a reserved circuit, and also in a node (D) If channel ch.1 between nodes (A) is connected as what was turned up by channel ch.25 of a reserved circuit, the incorrect connection to which the signal of a node (A) is transmitted to a node (D) will arise.

[0014] Then, if a request is sent out based on the squelch table of (B) and (D) which became a switching node by transmission-line failure detection Since a node (A) is not reached, in a node (B) The squelch (pass-alarm=display signal=AIS) shown by S is inserted in channel ch.25 of the reserved circuit turned up to a node (A) moreover, between the nodes (A) changed from a reserved circuit also in a node (D) -- present -- business -- the squelch (pass-alarm=display signal=AIS) shown by S is inserted in channel ch.1 of a circuit. An incorrect connection condition is avoidable with this squelch.

[0015] If drawing 35 is the judgment explanatory view of a single failure and two or more failures, a failure generates (a) between a node (F) and (E) and a node (E) detects the transmission-line failure SF (Signal Fail) The request (transmission-line failure) of the long pass shown by SF-R/F/E/Long to a node (D) side is sent out to the node (F) of an opposite station, and Short Pass's request (transmission-line failure) shown by SF-R/F/E/Srt/RDI is sent out to a node (F) side. A node (F) can be judged by the request addressed to the local station of Short Pass from the node (E) of an opposite station and a long pass being receivable to be a single failure between a node (F) and (E).

[0016] Moreover, when a failure generates (b) of drawing 35 between a node (B), between (C) and a node (F), and (E), and a node (C) detects the transmission-line failure SF and a node (E) detects the transmission-line failure SF, a node (C) sends out request (transmission-line failure) SF-R/B/C/Long of a long pass and Short Pass, and SF-R/B/C/Srt/RDI to the node (B) of an opposite station. The node (B) which received Short Pass's request SF-R/B/C/Srt/RDI sends out request SF-R/C/B/Long of a long pass to a node (C).

[0017] Moreover, the node (E) which detected the transmission-line failure SF sends out request SF-R/F/E/Long of a long pass and Short Pass, and SF-R/F/E/Srt/RDI to the node (F) of an opposite station like the case of (a), and a node (F) sends out request SF-R/E/F/Long of a long pass to a node (E) by Short Pass's request SF-R/F/E/Srt/RDI.

[0018] Therefore, although Short Pass's request SF-R/F/E/Srt/FDI is addressing to a local station from a node (E), since request SF-R/C/B/Long of a long pass is not addressing to a local station but addressing to a node (C) of a node (B) to an other station, a node (F) can judge it between a node (F) and (E) to be two or more failures of a between [a node (B) and (C)].

[0019] Moreover, the node status changes to an idle state, the switching State, and the passthrough State, and, in the usual case, it is an idle state. moreover, any of the bridge which changes the signal of a work-piece channel (present -- business -- a circuit channel) to a protection channel (reserved-circuit channel) according to failure generating, and the switch which returns a protection channel to a work-piece channel -- or it changes to any of the node of the switching State which performs both, and the node of the passthrough State located between the nodes of this switching State.

[0020] Moreover, although an APS (automatic protection change) protocol is performed between the nodes which sandwich the point generating [failure] using the side (Short Pass) and opposite hand (long pass) which the failure generated, the node of the mid-position serves as the passthrough State and the monitor of an APS protocol is performed, termination of the K bytes as an APS code is not performed. And the squelch which inserts P-AIS to the channel which stops being in a normal connection condition according to two or more failure generating is performed.

[0021]

[Problem(s) to be Solved by the Invention] The identification number of a transmitting node (node which inserts a signal), and the identification number of a receiving node (node which drops a signal) are used for the squelch table prepared in each node at the time of communication channel setting out between nodes, and it forms them in a channel response at it. Since a processor will perform retrieval processing of a squelch table for the node to which a signal cannot reach a channel response based on an identification number and collating of an identification number and a comparison will be performed in detail when software performs all control that performs squelch insertion using this squelch table at the time of two or more failure generating, there is a problem to which the time amount which a squelch judging takes becomes long.

[0022] moreover, the ring transmission system of a BLSR method with 1200km of transmission-line length by the optical fiber, and 16 nodes -- setting -- the loop back for the failure relief from failure detection -- present -- to be 50 or less ms is demanded till the completion of a change of business and a preliminary change. Moreover, in the case of two or more failures, to be 100 or less ms is demanded. Therefore, since it is necessary to perform change processing at high speed and squelch processing is needed at the time of two or more failures, after failure detection also needs to accelerate this squelch processing.

[0023] Then, it is possible to consider all squelch processings as the configuration which can be performed by hardware. However, since a squelch table stores a node identification number corresponding to a channel response and the transceiver direction of a signal, this squelch table and the circuitry which collates and compares the identification number of the node which a signal cannot reach according to two or more failures become very complicated and large-scale, and implementation has a difficult problem. This invention aims at attaining improvement in the speed of squelch processing, without increasing circuit magnitude.

[0024]
[Means for Solving the Problem] In the ring transmission system of the bidirectional line switch ring method to which the ring transmission system of this invention connected the node of (1) plurality according to the ring transmission line each node The MODIFAIDO node identification number which shows the sequence connected to the ring transmission line on the basis of the self-node, and the identification number of each node are made to correspond. The MODIFAIDO squelch table showing between the communication link nodes by the MODIFAIDO node identification number, It has the squelch judging section which performs a squelch judging by the size comparison with the MODIFAIDO node identification number which shows between the communication link notes stored in this MODIFAIDO squelch table, and the MODIFAIDO node identification number of the node which the signal by failure generating does not reach.
[0025] (2) The control-system unit with which a **** node manages a ring topology and a squelch table, The change system unit which performs an automatic protection change protocol and performs a change demand by transmission-line failure detection, signal quality degradation detection, and both-system main signal system unit omission detection, The main signal system unit is included. This main signal system unit The line switch which changes by the change demand from a change system unit, The MODIFAIDO squelch table formed based on the ring topology and squelch table of a control-system unit, It has the squelch judging section which performs a squelch judging with reference to this MODIFAIDO squelch table, and the squelch activation section which performs the squelch by the squelch judging result.
[0026] (3) Moreover, set two or more nodes to the squelch approach of the ring transmission system of the bidirectional line switch ring method which connected according to the ring transmission line. When building a ring topology required in order to form a squelch table, the node which performs ring topology construction directions The node which sent out the ring topology frame which added the self-node identification number to the head, and received this frame A self-node identification number is inserted and transmitted in order of reception, and the process in which the ring topology [node / each / identification number / of a self-node / head] based on the order of a node identification number inserted in the frame which took a round of the ring transmission line is built is included.
[0027] (4) Based on a ring topology, a **** node gives the MODIFAIDO node identification number according a self-node to the number of ascending order or descending order as a criteria channel, and includes the process which forms the MODIFAIDO squelch table which changed the node identification number of a squelch table into the MODIFAIDO node identification number.
[0028] (5) A MODIFAIDO node identification number can be given to ascending order according to the clockwise rotation or the counter clockwise order of connection by the ring transmission line, being able to use the MODI fiber node identification number of a **** node as 0.
[0029] (6) Moreover, when a failure occurs between nodes, the node which a signal cannot reach can be identified and the process in which the size comparison with the MODIFAIDO node identification number of this node and the MODIFAIDO node identification number of a MODIFAIDO squelch table performs a squelch judging can be included.
[0030] (7) Moreover, when it identifies that a transmitting node or a receiving node exists in a different subring from the subring to which a self-node belongs among the subrings formed of two or more failure generating with reference to a MODIFAIDO squelch table, it can judge with a squelch being required.
[0031] (8) moreover, a ring transmission line -- present -- business -- the node status which shows the idle state of forward always, and the passthrough condition at the time of failure generating and the switching condition by the side of yeast and the waist can be set up including a circuit and a reserved circuit, and the process in which the squelch judging to a reserved-circuit channel is performed according to the node status can be included.
[0032] (9) Moreover, when the node status shows a passthrough condition, the process in which a squelch is performed before time-slot assignment to all the drop side of a reserved-circuit channel can be included.
[0033] (10) Moreover, when the node status shows a switching condition, while a MODIFAIDO node identification number performs a squelch judging with reference to a MODIFAIDO squelch table, the process in which perform a squelch before time-slot assignment to all the drop side of a reserved-circuit channel, and a squelch is performed to the input side and output side of a node of a reserved-circuit channel can be included.
[0034] (11) Moreover, in the squelch approach of the ring transmission system of the BLSR method which connected two or more nodes according to the ring transmission line, the process in which a

squelch is compulsorily performed to an intact circuit at the time of the judgment which needs a squelch according to failure generating can be included.

[0035] (12) Moreover, a self-node identification number or the MODIFAIDO node identification number of a self-node is storable in the intact circuit channel of a squelch table or a MODIFAIDO squelch table.

[0036] (13) A **** node can include the process notified to a control-system unit except for the compulsory squelch to an intact circuit channel among the squelch judging results in the main signal system unit.

[0037]

[Embodiment of the Invention] Drawing 1 is the ring topology construction explanatory view of the example of this invention, and as shown in (a), four node (A) - (D) gives an identification number to each node in the system connected by the ring transmission line RL. For example, it gives as ID=15 of a node (A), ID=3 of a node (B), ID=7 of a node (C), and ID=8 of a node (D). Next, as shown in (b), the node which issued ring topology (ring map) construction directions, for example, a node, (A) sets the number of ** insertion nodes to 1, and it sends out clockwise the ring topology frame which added ID of a self-node as the 1st. A node (B) sets the number of ** insertion nodes to 2, and inserts and sends out ID of a self-node to the degree of ID of a node (A). A node (C) sets the number of ** insertion nodes to 3, and inserts and sends out the self-node ID to the degree of ID of a node (B). A node (D) sets the number of ** insertion nodes to 4, and inserts and sends out ID of a self-node to the degree of ID of a node (C).

[0038] A node (A) is **-** which notifies the ring topology frame which added and sent out the END flag to the tail end of a ring topology frame, and was completed to each node as it identifies having taken a round and it is shown in (c) from the 1st of the insertion node ID being the self-node ID. Each node which received this ring topology frame builds the ring topology which made the self-node the head. For example, it is set to "15, 3, 7, 8" in a node (A), and becomes "8, 15, 3, 7" by "7, 8, 15, 3", and the node (D) by the node (B) at "3, 7, 8, 15", and a node (C).

[0039] According to the above-mentioned ring topology construction, it becomes easy to send out the self-node ID and the object node ID by K1 by the above-mentioned APS protocol and K2 byte. Moreover, a squelch table is formed based on this ring topology.

[0040] Although drawing 2 and drawing 3 are the explanatory views of squelch table formation, each node (A) - (D) has a squelch table, respectively and ID of a node is stored, it explains using the same sign as node (A) - (D) for simplification. When transmitting and receiving a signal through a node (B) and (A) between a node (C) and (D), like ** of (a) of drawing 2 for example, a node (C) Insert the self-node ID "C" in the table important section of a channel response of a graphic display, and it sends out to a node (B) side. It notifies that the terminal office is a node (C), and a node (D) inserts the self-node ID "D" in the table important section corresponding to a channel of a graphic display, sends it out to a node (A), and notifies ** whose terminal office is a node (D). * mark and * mark in that case -- a phase hand -- supposing that it is unknown is shown.

[0041] And as shown in ** of (b) of drawing 2 , to a node (B), it notifies that the terminal office by the side of a node (A) is a node (D) through a node (A) from a node (D), and notifies at it that the terminal office by the side of a node (B) is a node (C) to a node (A) through a node (B) from a node (C).

[0042] Next, as shown in ** of (a) of drawing 3 , it notifies that the terminal office is a node (D) to a node (C) through a node (B), and notifies that the terminal office is a node (C) to a node (D) through a node (A). The self-node ID "C" and the node ID of an opposite station "D" are set to the squelch table of a node (C) by it, and the self-node ID "D" and the node ID of an opposite station "C" are set to the squelch table of a node (D).

[0043] As shown in ** of (b) of drawing 3 , next, based on the squelch table which a node (C) and (D) completed From a node (C), it notifies that phase hand unknown * is ID "D" of a node (D) to a node (B). Moreover, as it notifies that phase hand unknown * is ID "C" of a node (C) to a node (A) and is shown in ** from a node (D) It notifies that phase hand unknown * is ID "D" of a node (D) to a node (A) from a node (B), and notifies that phase hand unknown * is ID "C" of a node (C) to a node (B) from a node (A). By it, the squelch table corresponding to the channel between a node (C) and (D) is completed also in a node (A) and (B). Moreover, in renewal of a squelch table, it can perform similarly. In addition, it controls to forbid renewal of a squelch table at the time of failure generating.

[0044] Drawing 4 is the explanatory view of the MODIFAIDO squelch table of the example of this invention. Node (A) In the system to which - (F) was connected by the ring transmission line RL When each identification number ID is given as 5, 11, 9, 7, 1, and 3, the ring topology [D] in a node (D) It is

set to "7, 1, 3, 5, 11, 9", and the ring topology [E] in a node (E) is set to "1, 3, 5, 11, 6, 7."
[0045] About a yeast [of a self-node] (EAST), and waist (WEST) side, a squelch table is stored so that left-hand side may serve as a transmitting node (source node which inserts a signal) and right-hand side may serve as a receiving node (DISUTE nation node which drops a signal), when the transmission direction is E->W, and when the transmission direction is E<-W, it stores in every [of a signal] transmission direction (DIREC) so that right-hand side may serve as a transmitting node and left-hand side may serve as a receiving node. in addition, one optical-fiber-transmission way -- present -- business -- the channel relieved by the loop back at the time of failure generating when referred to as circuit channel ch.1-ch.24 and reserved-circuit channel ch.25-ch.48 -- present -- business -- since it is only channel ch.1-ch.24 of a circuit, a squelch table can also be formed to channel ch.1-ch.24.
[0046] The squelch table [E] of the above-mentioned node (E) As shown in the lower left, the transmitting node in the case of the transmission direction of E->W by the side of yeast (EAST) (F), i.e., a node ID=3 and a receiving node are ID=7 and it turns out that the transmitting node in the case of the transmission direction of E->W by the side of the waist (WEST) (D), i.e., a node, is ID=3, and a receiving node is ID=7. In addition, 3F and 7D It is shown that the nodes ID of a node (F) and (D) are 3 and 7.
[0047] Moreover, as the squelch table [D] of a node (D) is shown in the upper left, the transmitting node in the case of the transmission direction of E->W by the side of yeast (EAST) (E), i.e., a node, is ID=3, a receiving node is ID=7, and it turns out that it is a self-node. Moreover, since a waist (WEST) (C), i.e., node, side does not transmit and receive, ID=7 of a self-node are stored as ID of a transmitting node and a receiving node. Moreover, ID of a node is similarly stored about the transmission direction of E<-W.
[0048] When a failure occurs between a node (A), between (F) and a node (D), and (E), for example, a node (E) the waist (WEST) side loop back by the transmission-line failure between nodes (D) -- self--- by the conditions of ID=3 and ring topology of the node (F) by the request of the long pass from node ID=1 and a node (F) It turns out that a signal does not reach [ID] the node of 5, 11, 9, and 7. Then, ID of the transmitting node of a squelch table [E] and a receiving node is compared for a squelch judging. In this case, since ID=7 are a node which a signal does not reach, they perform a squelch.
[0049] As mentioned above, when the node which a signal does not reach according to two or more failures occurred, ID of the node and ID of the transmitting node and receiving node which were stored in the squelch table needed to be collated, collating would be performed to two or more channel responses, the existence of the need for a squelch will be judged, and there were many throughputs of a squelch judging. Then, a MODIFAIDO squelch table is formed in this invention.
[0050] The above-mentioned ring topology stores ID of a self-node in a head in order of connection of a ring transmission line, and stores ID of each node in order, and a node (D) and (E) are shown in the ring topology [D] of drawing 4 , and [E]. Then, a self-node is set to 0 and a number is assigned to ascending order one by one. Therefore, although the ring topologies [E] of a node (E) are "1, 3, 5, 11, 9, 7" as mentioned above by ID of each node, the MODIFAIDO node ID (Md, ID) is set to "0, 1, 2, 3, 4, 5." Similarly, by ID of each node, although the ring topologies [D] of a node (D) are "7, 1, 3, 5, 11, 9", MODEFAIDO ID (Md, ID) is set to "0, 1, 2, 3, 4, 5" by them.
[0051] A MODEFAIDO squelch table is formed from a squelch table using this MODEFAIDO node ID. Therefore, as the MODIFAIDO squelch table [D] of a node (D) is shown in the upper right, MODIFAIDO node ID=2 (node ID=3) and a receiving node are set to MODIFAIDO node ID=0 (node ID=7; self-node) by the transmitting node of the transmission direction of E->W by the side of yeast (EAST). Similarly, as the MODIFAIDO squelch table [E] of a node (E) is shown in the lower right, MODIFAIDO node ID=1 (node ID=3) and a receiving node are set to MODIFAIDO node ID=5 (node ID=7) by the transmitting node of the transmission direction of E->W by the side of yeast (EAST).
[0052] And as mentioned above, when a failure occurs between a node (D) and (F) and between a node (A) and (F), in a node (E), in the above-mentioned case, it turns out that Nodes ID are 5, 11, 9, and 7, but as for the node which a signal does not reach, according to the MODIFAIDO node ID, it turns out that a signal does not reach the node of 2-5. That is, it turns out that they are Md and the node of ID>=2. Therefore, a squelch will be performed to Md in a MODIFAIDO squelch table [E], and the node of ID>=2. This can show that a squelch judging is possible by the size comparison of the MODIFAIDO node ID, and can perform a squelch judging by the easy comparison circuit at high speed.
[0053] drawing 5 -- the explanatory view of the unit configuration of a node -- it is -- PW -- for a control-system unit and HS, a change system unit, HR (1), and HR (2) are [a power supply unit and SV / a monitor unit and MP / the main signal system unit, HT (1), and HT (2) of a receiving interface unit, HM (1), and HM (2)] transmitting interface units. For example, the signal from a yeast (EAST)

side is received, and the receiving interface unit HR (2) receives the signal from a waist (WEST) side, and the receiving interface unit HR (1) transmits the transmitting interface unit HT (1) to a waist (WEST) side, and transmits the transmitting interface unit HT (2) to a yeast (EAST) side. When an optical fiber constitutes a transmission line, the function of photo electric translation and current to light transference is included. moreover, the main signal system unit HM (1) -- present -- business -- if it is a system (WORK), the main signal system unit HM (2) will serve as a reserve system (PTCT).

[0054] Drawing 6 is the change actuation explanatory view of the node at the time of failure generating, and indicates the changes by the transmitting interface units HT (1) and HT (2) to be the receiving interface units HR (1) and HR (2) shown in drawing 5 , the main signal system unit HM (1), and HM (2). moreover, the main signal system unit HM (1) and HM (2) -- the same configuration -- having -- 11 -- for the switch squelch section and 14, as for the insertion time-slot assignment section (ADD TSA) and 16, the separation time-slot assignment section (DROP TSA) and 15 are [the pointer processing section and 12 / the ring switch section and 13 / the bridge squelch section and 17] the ring bridge sections.

[0055] moreover, two transmission lines -- between each node -- connecting -- each transmission line -- 48 channels -- having -- channel ch.1-ch.24 among the 48 channels -- present -- business -- consider as a circuit (WK) and a (work-piece channel), and let channel ch.25-ch.48 be a reserved circuit (PT) and a (protection channel). Moreover, the pointer processing section 11 identifies the head location of the signal multiplexed by the pointer by the H1-H3 byte of for example, the section over head SOH, and controls each part.

[0056] For example, as a failure occurs in the yeast (EAST) side of a node and the receiving interface unit HR (1) and the transmitting interface unit HT (2) show by x mark, when it cannot be used, By the ring switch section 12 of the main signal system unit HM (1), channel ch.24-ch.48 of the reserved circuit by the side of the waist (WEST) a yeast (EAST) side -- present -- business -- it switches to channel ch.1-ch.24 of a circuit, and the bridge of channel ch.1-ch.24 is carried out to channel ch.25-ch.48 by the side of the waist (WEST) by the ring bridge section 17.

[0057] Therefore, the signal addressed to a self-node which it was turned up by channel ch.24-ch.48 of a reserved circuit, and was received from the waist (WEST) side can be dropped in the separation time-slot assignment section 14. moreover, the insertion time-slot assignment section 15 -- setting -- present -- business -- the signal inserted in channel ch.1-ch.24 of a circuit is sent out by channel ch.25-ch.48 of a reserved circuit from a waist (WEST) side.

[0058] In the ring bridge section 17, the bridge of channel ch.1-ch.24 of a circuit is carried out to channel ch.25-ch.48 of a reserved circuit. moreover, a waist (WEST) side -- present -- business -- It switches to channel ch.1-ch.24 of a circuit. channel ch.25-ch.48 of the reserved circuit by the side of the waist (WEST) -- the ring switch section 13 -- setting -- present -- business -- The loop back who turns up the signal from a waist (WEST) side to a waist (WEST) side can be formed.

[0059] As mentioned above, the switch squelch section 13 and the ring squelch section 16 perform the squelch which inserts P-AIS with reference to a MODEFAIDO squelch table, when a signal cannot reach according to two or more failure generating.

[0060] Drawing 7 is a node control function block diagram, and shows the monitor unit SV, the control-system unit MP and the change system unit HS, the main signal system unit HM, and the receiving interface unit HR and the transmitting interface unit HT. The control-system unit MP forms a squelch table with a means which builds a ring topology with a means which explained drawing 1 , and explained drawing 2 and drawing 3 . Moreover, as for the main signal system unit HM, according to the switch request of the change system unit HS, a change is performed including a line switch, the squelch judging section, the squelch activation section, and a MODIFAIDO squelch table, as for a line switch.

[0061] The control-system unit MP manages a ring topology and a squelch table, when the ring topology is not built, it requires Default APS of the change system unit HS, and it passes the built ring topology to the change system unit HS. Moreover, the request of the compulsive switch from the monitor unit SV, a manual switch, a test switch, etc. is passed to the change system unit HS.

[0062] When the input signal by the receiving interface unit HR is supervised and the transmission-line failure SF or the signal quality degradation SD is detected, or when both-system failure HM-ALM-1&2, when a both system samples the main signal system unit HM is detected, the change system unit HS performs an APS protocol by making these into a change trigger, and sends out the switch request by the result to the main signal system unit HM. Moreover, in the case of the both-system failure of the main signal system unit HM, the K2 byte status [bit / 6-8th] is notified as "100" at other nodes.

[0063] The squelch judging section performs the squelch by which a squelch judges whether it is the

need and the main signal system unit HM inserts P-AIS in a predetermined channel by the squelch activation section with reference to the MODIFAIDO squelch table formed based on the squelch table of the control-system unit MP by the switch request from the change system unit HS. Moreover, the main signal system unit HM notifies the change processing and the squelch judging result by the line switch, and an activation result to the control-system unit MP. In addition, since renewal of a squelch table is forbidden at the time of failure generating, there will be no guarantee whose relation between the content of the squelch table and time-slot assignment corresponds. Then, a squelch is performed also to an intact circuit (UNEQ) and it does not notify to the control-system unit MP about the squelch. moreover, the failure of the both sides by the side of yeast and the waist -- **** -- a squelch will be performed when a **** node is not a switching node in the case of the node which changed into the isolated condition, or a single failure.

[0064] Drawing 8 is the explanatory view of a squelch judging. (a) The system shown in drawing 4 and the system to which six node (A) - (F) to which the same node identification number ID was given was connected by the ring transmission line are shown. When having transmitted and received the signal between a node (D) and (F) and a failure occurs between a node (A) and (F) and between a node (D) and (E), a node (D) forms the loop back in a yeast (EAST) side by transmission-line failure SF detection. The ring topologies in this case [D] are "7, 1, 3, 5, 11, 9", as shown in (b). A MODIFAIDO squelch table in case the signal between nodes (F) transmits and receives Since it is MODIFAIDO node ID=2 of the node (F) of node ID=3, as shown in (c), the direction of E->W and the direction of E<-W of a yeast (EAST) side are set to "2, 0." That is, the pass between 2[F] -0 [D] will be formed.

[0065] By activation of the APS protocol in the change system unit HS (refer to drawing 7), since the node which a signal reaches, i.e., the node of fur end node ID=5, (A) is discriminable, it changes into MODIFAIDO node ID=3 of this node (A), and notifies to the main signal system unit HM. That is, as shown in (d) of drawing 8 , "1" notifies the switch condition Sw the bridge condition Br by the MODEFAIDO fur end node ID (FEID=3[A]) of the node (A) by "0011", the node status ST which is a yeast (EAST) side switch by "10", and "1." In addition, the node status ST expresses "00" = idle state, "01" = passthrough condition, "10" = yeast side switching condition, and "11" = waist side switching condition. Moreover, the fur end node ID in the case of a single failure is set to "000" which shows a self-node.

[0066] As mentioned above, in a node (D), a signal does not reach from a yeast (EAST) side for a yeast (EAST) side failure. That is, in the ring topology [D] shown in (e) of drawing 8 , the signal from the node beyond MODIFAIDO node ID=1 does not reach. Moreover, the fur end node (A) by the side of the waist (WEST) is a node of the limitation that the signal from a waist (WEST) side reaches. That is, in the ring topology [D] shown in (f) of drawing 8 , the signal from the node not more than MODIFAIDO node ID=2 does not reach. therefore, the node which a signal does not reach in the ring topology [D] shown in (b) of drawing 8 -- MODIFAIDO node ID= -- it turns out that it is 1 and 2.

[0067] In this case, since it turns out that a signal does not reach two or less node, if there is a node which a signal does not reach with reference to a MODIFAIDO squelch table, the MODIFAIDO node ID Namely, if there is two or less MODIFAIDO node ID, since it can judge with a squelch being required, it sets on the MODIFAIDO squelch table shown in (c) of drawing 8 . There is two or less MODIFAIDO node ID, and a squelch will be performed to this channel.

[0068] Drawing 9 is the explanatory view of a squelch judging, and (a) shows the same system as (a) of drawing 8 . Moreover, as the ring topology [E] in a node (E) is shown in (b), it is set to "1, 3, 5, 11, 9, 7", and since it becomes the communication link between MODIFAIDO node ID=1 and 5 between a node (F) and (D), the pass between 1[F] -5 [D] will be formed. Therefore, as shown in (c), a MODIFAIDO squelch table [E] is set to "1, 5" about a waist (WEST) side.

[0069] By activation of the APS protocol by the failure between a node (A) and (F) and between a node (E) and (D), moreover, to the main signal system unit HM, from the change system unit HS "0001" (FEID=1[F]) which changed ID of a fur end node (F) into the MODIFAIDO node ID as shown in (d), The node status ST of "11" and the bridge condition Br of "1" which show a waist side switch condition, and the switch condition Sw of "1" are notified.

[0070] Moreover, since it is a waist side failure, in the ring topology [E] shown in (e), a signal does not reach from a waist side (right-hand side). Moreover, in the ring topology [E] (f) Shown, a fur end node is a node (F) and a signal does not reach the node of the MODIFAIDO node ID of the value exceeding this MODIFAIDO node ID=1. Therefore, since it turns out that a signal does not reach the node beyond MODIFAIDO node ID=2 as shown in the ring topology [E] of (b), if two or more MODIFAIDO nodes ID are shown in a MODIFAIDO squelch table [E], it will judge with a squelch being required. In this

case, since the node (D) of MODIAIDO ID=5 exists, a squelch will be performed to that channel.
[0071] Drawing 10 is the explanatory view of squelch processing, the squelch processing in the same condition as (a) of drawing 8 is shown, in S, a switch side squelch and B show a bridge side squelch, and a dotted line shows a reserved circuit. Since a node (A), (D), (E), and (F) will detect the transmission-line failure SF, respectively, they become a switching node.
[0072] Moreover, the MODIFAIDO squelch table [D] DIREC, for example, the transmission direction of channel ch.1, of a node (D) is shown. The transmitting node of the direction of E->W by the side of yeast (EAST) The node of MODIFAIDO node ID=2 (F), A receiving node is a self-node (D), and the transmitting node of the direction of E<-W is a self-node (D), and a receiving node is a node (F) of MODIFAIDO node ID=2. According to a yeast (EAST) side failure The direction of E->W uses Switch Sw and the direction of E<-W as Bridge Br, and the direction of E->W by the side of the waist (WEST) shows the case where Bridge Br and the direction of E<-W are considered as Switch Sw.
[0073] For example, in a node (D), since a signal does not reach the node of MODIFAIDO node ID=2 of channel ch.1 (F) with reference to a MODIFAIDO squelch table [D], a squelch is performed. Moreover, in a node (E), a squelch is similarly performed about channel ch.1 to the node (D) which a signal does not reach with reference to a MODIFAIDO squelch table.
[0074] Drawing 11 and drawing 12 are the explanatory views of the yeast side squelch judging section, drawing 11 shows the bridge by the side of the yeast (EAST) of a node (E), drawing 12 shows the case of the switch by the side of yeast (EAST), the gate circuit where 21, 22, 41, and 42 output "1" when an AND circuit (&), and 23 and 43 are not FEID=0, and 24 and 44 are inverters, and they constitute the channel common section.
[0075] Moreover, the gate circuit where 25, 26, 45, and 46 output "1" when the MODIFAIDO node ID of a transmitting node or a receiving node of a comparator (COMP), and 27, 28, 47 and 48 is not 0, The gate circuit where 29 outputs [both] "1" when the MODIFAIDO node ID of a transmitting node and a receiving node is 0 (self-node) (ALL0), An OR circuit (OR), and 34 and 54 are registers, and, as for an AND circuit (&), and 32 and 52, 30, 31, 33, 50, 51, and 53 constitute a channel corresponding point. channel ch.1-ch.24 [moreover,] -- present -- business -- a circuit and channel ch.25-ch.48 -- a reserved circuit -- ** -- it carries out.
[0076] Moreover, in the case of fur end node ID=4 based on the ring topology [E] by the MODIFAIDO node ID, the control information from the change system unit HS to the main signal system unit HP is set to "01001011." That is, it becomes FEID(fur and MODIFAIDO node identification number) = "0100", node status ST= "10" which shows a yeast side switch, Br= "1" which shows a bridge condition, and Sw= "1" which shows a switch condition.
[0077] Moreover, the transmitting node solvent refined coal (source node) and the receiving node DEST (DISUTE nation node) according [a MODIFAIDO squelch table [E]] to the switch condition Sw, the bridge condition Br, and the MODIFAIDO node ID corresponding to the yeast (EAST) side [of a node (E)], waist (WEST) side, and transmission direction DIREC (E->W, E<-W) as mentioned above are stored.
[0078] In the channel common section in drawing 11 , the fur end node ID (FEID) is outputted as **, and "1" of the head of "10" of the node status ST is inputted into AND circuit 22, a gate circuit 23 is reversed "1" and the following "0" is inputted into AND circuit 21. Moreover, "1" of the bridge condition Br is inputted into AND circuit 21. Output ** in this case is set to "1", and shows yeast bridge EAST/Br. Moreover, since the output of a gate circuit 23 is FEID!=0, it is set to "1", and output ** of AND circuit 21 is set to "1." Moreover, the switch condition Sw of "1" will be inputted in AND circuit 42 of the channel common section in drawing 12 , and each output [in this case] ** - ** become the same as that of each output [of the channel common section of drawing 11] ** - ** in it.
[0079] Moreover, in a channel corresponding point, comparators 25 and 45 compare the MODIFAIDO node ID (East SRCBr, East solvent-refined-coal Sw) of the transmitting node by the side of yeast (EAST) with FEID, comparators 26 and 46 compare the MODIFAIDO node ID (East DEST Br, East DEST Sw) of the receiving node by the side of yeast (EAST) with FEID, and, in B<A, an output is set to "1." That is, in the case of the MODIFAIDO node ID smaller than FEID, "1" is outputted.
[0080] Moreover, when the MODIFAIDO node ID of a transmitting node and a receiving node is not 0, Namely, when it is not what shows a self-node, the output of gate circuits 27, 28, 47, and 48 is set to "1", and if the output of comparators 25, 26, 45, and 46 is "1" If the output of AND circuits 30, 31, 50, and 51 is set to "1", it is inputted into AND circuits 33 and 53 through OR circuits 32 and 52 and output ** of AND circuits 21 and 41 of the channel common section is "1" The output of AND circuits 33 and 53 is set to "1", will be set to registers 34 and 54, and will display a squelch decision channel. Moreover,

when both the MODIFAIDO nodes ID of a transmitting node and a receiving node are 0, the output of a gate circuit 29 is set to "1", an intact circuit will be shown in this case, the output of "1" of AND circuit 33 will be set to the register 34 of this channel corresponding point, and the squelch decision to an intact channel will be displayed.

[0081] Drawing 13 shows the bridge by the side of the waist (WEST) of a node (E), drawing 14 shows the case of the switch by the side of the waist (WEST), when an AND circuit (&), and 63 and 73 are not FEID=0, they are a gate circuit which outputs "1", drawing 13 and drawing 14 are the explanatory views of the waist side squelch judging section, and 61, 62, 71, and 72 constitute the channel common section.

[0082] Moreover, 64 and 74 are the registers showing a squelch decision channel. Moreover, a comparator (COMP), and 67 and 77 are gate circuits (ALL0) where both an AND circuit (&) and 69 output "1" as for an OR circuit (OR), and 68 and 78 when the MODIFAIDO node ID of a transmitting node and a receiving node is 0, and 65, 66, 75, and 76 constitute a channel corresponding point.

[0083] Moreover, in the case of fur end node ID=4 based on the ring topology [E] by the MODIFAIDO node ID, the control information from the change system unit HS to the main signal system unit HP is set to "01001111." That is, it becomes FEID(fur and MODIFAIDO node identification number) = "0100", node status ST= "11" which shows a waist side switch, Br= "1" which shows a bridge condition, and Sw= "1" which shows a switch condition.

[0084] Output ** of the channel common section in this case is FEID, and output ** and ** are set to "1." Moreover, in the case of the transmitting node of the MODIFAIDO node ID of a value or receiving node to objection with the larger comparator of drawing 11 and the channel corresponding point of drawing 12 than FEID, the comparators 65, 66, 75, and 76 of a channel corresponding point set an output to "1." Moreover, if the output of comparators 65, 66, 75, and 76 is "1" when output ** of the channel common section is "1", the output of AND circuits 68 and 78 is set to "1", will be set to registers 64 and 74, and will display the channel of squelch decision. Moreover, it indicates that the intact circuit by the side of a bridge is identified by the gate circuit 69, and it performs a squelch.

[0085] Drawing 15 is the explanatory view of the point inserting [squelch], and the important section of the time-slot assignment section of the main signal system unit HM is shown. (WEST) shows a waist side and (EAST) shows a yeast side. 80 A selector (E/WSEL), 81-84 A waist side or the yeast side time-slot assignment section (TSA), As for the alarm-display signal section (AIS), and 93 and 94, for the insertion section (INS), and 87-90, the switch section (S), and 95 and 96 are [the squelch section (SQBr, SQSw), and 91 and 92 / 85 and 86] the bridge sections (B). moreover, a continuous line -- present -- business -- a circuit (ch.1-ch.24) and a dotted line show a reserved circuit (ch.25-ch.48).

[0086] The signal which the signal dropped by a yeast side or the waist side time-slot assignment sections 82 and 83 through the selector 80 is sent out through a selector 80, and is inserted is inputted into a yeast side and the waist side time-slot assignment sections 81 and 84. Moreover, for example, the waist (WEST) side bridge of a node is performed by the bridge section 96, and the bridge squelch in that case is performed by insertion of P-AIS by the squelch section 87. Moreover, a yeast (EAST) side switch is performed by the switch section 93, and the switch squelch in that case is performed by insertion of P-AIS by the squelch section 88.

[0087] Drawing 16 is the flow explanatory view of the signal at the time of the yeast side loop back, and the same sign as drawing 15 shows the same part, and shows the case where it acts as the loop back by the waist (WEST) side, according to failure generating by the side of the waist (WEST) of a node. namely, a receiving yeast (EAST) side -- present -- business -- if the insertion section 85 and the bridge section 96 are controlled and a sign shows channel ch.1-ch.24 of a circuit, it is the path of 93->88->85->87->96, and it will act to channel ch.25-ch.48 of the reserved circuit by the side of transmitting yeast (EAST) as the loop back, and P-AIS insertion will be performed by squelch judging to a squelch judging channel by the squelch section 87.

[0088] moreover -- if the switch section 94 and the insertion section 86 are controlled and a sign shows channel ch.25-ch.48 of the reserved circuit by the side of receiving yeast (EAST) -- the path of 94->89->86->90 -- it is -- a transmitting yeast (EAST) side -- present -- business -- it acts to channel ch.1-ch.24 of a circuit as the loop back, and P-AIS insertion is performed by squelch judging to a squelch judging channel by the squelch section 89.

[0089] Drawing 17 is the flow explanatory view of the signal at the time of the waist side loop back, and the same sign as drawing 15 shows the same part, and shows the case where it acts as the loop back by the yeast (EAST) side, according to failure generating by the side of the yeast (EAST) of a node. The control information which serves as the fur end node ID (FEID) from node status ST= "10" (yeast side switch), bridge Br= "1", and switch Sw= "1" is transmitted to the main signal system unit HM from the

change system unit HS in that case. and a receiving waist (WEAT) side -- present -- business -- if the insertion section 86 and the bridge section 95 are controlled and a sign shows channel ch.1-ch.24 of a circuit, it is the path of 94->89->86->90->95, and it will act to channel ch.25-ch.48 of the reserved circuit by the side of the transmitting waist (WEST) as the loop back, and P-AIS insertion will be performed by the squelch section 90 to a squelch judging channel.

[0090] moreover -- if the switch section 93 and the insertion section 85 are controlled and a sign shows channel ch.25-ch.48 of the reserved circuit by the side of the receiving waist (WEST) -- the path of 93->88->85->87 -- it is -- a transmitting waist (WEST) side -- present -- business -- it acts to channel ch.1-ch.24 of a circuit as the loop back, and P-AIS insertion is performed by the squelch section 88 to a squelch judging channel.

[0091] As drawing 18 is the explanatory view of squelch processing to a reserved-circuit channel and it is shown in (a) It connects through a circuit and the reserved circuit of a dotted line. node (A) - (F) -- a continuous line -- present -- business -- While transmitting and receiving the signal in the path of a continuous-line arrow head with the PCA (protection channel access) pass between a node (F) and (D), as shown in (b) When a failure will occur between a node (A) and (F) and a reserved circuit will be used for a node (A) and (F) according to ring switch generating, respectively, it becomes impossible to use the PCA pass between a node (F) and (D). Therefore, the part which makes a through condition all the insertion parts of a reserved-circuit channel, and is dropped from a reserved-circuit channel will perform the squelch S which inserts P-AIS. That is, a passthrough node makes all reserved-circuit channels a through condition, it stops and signal insertion performs P-AIS insertion to a signal drop channel.

[0092] As drawing 19 is the explanatory view of the squelch processing in a switching node and it is shown in (a) node (A) - (F) being connected by the ring transmission line (it being based on a thin line -- present -- business -- the reserved circuit by the circuit and the dotted line), and, where the change system unit HS is drawn out in a node (B) and (D) As a thick wire shows between a node (E) and (D) between a node (F) and (E) between a node (C) and (F), while communicating by forming PCA pass, as shown in (b) the thin line which goes to a node (F) from a node (A) -- present -- business -- when a failure occurs on the PCA pass of a circuit and a thick wire, a squelch is performed by S points. That is, a node (F) and (E) make a reserved-circuit channel a through condition, and perform the squelch which inserts P-AIS in the channel which was being dropped from the reserved circuit.

[0093] Moreover, if the change system unit HS of a node (B) has escaped from the APS code from a node (A), since it will not be transmitted to a node (C) and (D), a node (C) and (D) are maintaining the condition of forward always. In order to notify that a reserved circuit cannot be used to such a node (C) and (D), the squelch which inserts P-AIS in the channel of a reserved circuit received from the failure generating part side in a switching node, the node (A) which became, and (F) is performed, and the channel of the reserved circuit sent out to a failure generating part side is made into a through condition. Or the squelch which inserts P-AIS also in the channel of the reserved circuit sent out to this failure generating part side is performed.

[0094] Drawing 20 is the explanatory view of squelch processing to a reserved-circuit channel, and the same sign as drawing 15 shows the same part, and shows the condition of a passthrough by node status ST[of the control information from the change system unit HS to the main signal system unit HM] = "01." That is, reserved-circuit channel ch.25-ch.48 by the side of yeast (EAST) are connected to reserved-circuit channel ch.25-ch.48 by the side of the waist (WEST) by the insertion section 85, and reserved-circuit channel ch.25-ch.48 by the side of the waist (WEST) are connected to reserved-circuit channel ch.25-ch.48 by the side of yeast (EAST) by the insertion section 86. In this case, to all the channels dropped through the time-slot assignment sections 82 and 83 and a selector 80 from a reserved-circuit channel, AIS is inserted from the alarm-display signal sections 91 and 92 before time-slot assignment.

[0095] Drawing 21 is the explanatory view of squelch processing to a reserved-circuit channel, and the same sign as drawing 15 shows the same part, and shows the condition of a yeast switch by node status ST[of the control information from the change system unit HS to the main signal system unit HM] = "10." namely, the signal by reserved-circuit channel ch.25-ch.48 from a waist (WEST) side -- the switch section 93, the squelch section 88, the insertion section 85, and the squelch section 87 -- minding -- a waist (WEST) side -- present -- business -- it is sent out by circuit channel ch.1-ch.24. And P-AIS is inserted in reserved-circuit channel ch.25-ch.48 by the side of the waist (WEST) from the squelch section 87, and a squelch is performed.

[0096] moreover -- from a waist (WEST) side -- present -- business -- if only a sign shows the signal of circuit channel ch.1-ch.24 -- the path of 94->89->86->90->95 -- it is -- reserved-circuit channel ch.25-

ch.48 by the side of the waist (WEST) -- sending-out ****. Moreover, to all the channels dropped through the time-slot assignment sections 82 and 83 and a selector 80, the alarm-display signal sections 91 and 92 to AIS is inserted before time-slot assignment from reserved-circuit channel ch.25-ch.48 by the side of yeast (EAST) and the waist (WEST).

[0097] Drawing 22 is an explanatory view at the time of service selector setting out, 100 is a service selector (SS) and 101 is drop - and - continuing section. According to a ring transmission line, while was connected, and node (A) - (F) is the same as that of this, and also connects the transmission system of a way with a transmission system through a node (D) and (E). Between a node (A) and the node of the transmission system of another side When transmitting and receiving a signal by channel ch.1, while dropping the signal from a node (A) by drop [of a node (E)] -, and - continuing section 101, it sends out to a node (C). Moreover, the normaler one is chosen by the service selector 100 of a node (E), and the signal received from the transmission system of another side in the node (D) and the signal received from the transmission system of another side in the node (E) are sent out. Therefore, the transmission system of one side and another side will be connected by the doubled transmission line.

[0098] Drawing 23 and drawing 24 are the explanatory views of the squelch table at the time of service selector setting out, and show squelch table [A]- [F] corresponding to (Node A) - (F), and ring TOBOROJI[A]- [F]. In addition, 0-5 which are shown in the lower part of ring topology [A]- [F] show the MODIFAIDO node ID. For example, the ring topology [A] of a node (A) shows clockwise connection sequence to a head for a node (A) according to the connection configuration shown in drawing 22 , and the MODIFAIDO node ID sets a node (A) to 0, and is given to ascending order one by one.

[0099] Moreover, about ring TOBOROJI[B][of other node (B) - (F)] - [F], similarly, clockwise connection sequence is shown for a self-node in a head, and the MODIFAIDO node ID sets a self-node to 0, and is given to ascending order one by one. Moreover, squelch table [A]- [F] forms the MODIFAIDO squelch table which is omitting the graphic display on the MODIFAIDO node ID and the radical.

[0100] Moreover, as shown in drawing 23 , as for the transmitting node of the direction of E->W of channel ch.1 by the side of the waist (WEST), in the transmitting node of D and the direction of E<-W, D and a receiving node show A for the squelch table [A] of a node (A), as for A and a receiving node. Moreover, the squelch table [B] of a node (B) and (C) and [C] show the condition that channel ch.1 is not using it.

[0101] Moreover, the squelch table [F] of a node (F) shows the transmitting node A by the side of the yeast (EAST) of the direction of E->W of channel ch.1, the receiving node D, the transmitting node A by the side of the waist (WEST), and the receiving node D, and shows the transmitting node D by the side of the yeast (EAST) of the direction of E<-W, the receiving node A, the transmitting node D by the side of the waist (WEST), and the receiving node A. Moreover, about channel ch.1 of the squelch table [E] of a node (E), the same content as channel ch.1 of the squelch table [F] of a node (F) is stored. Moreover, about channel ch.1 of the squelch table [D] of a node (D), the transmitting node A of the direction of E->W by the side of yeast (EAST), the receiving node D, the transmitting node D of the direction of E<-W, and the receiving node A are stored.

[0102] In this case, in a node (E), although it is the case where the service selector 100 is set up, and choose the signal to the node (A) from two lines, and drop - and - continuing section 101 send out the signal from a node (A) to two lines, the node dropped and inserted eventually is stored in a squelch table as a receiving node and a transmitting node.

[0103] For example, although AIS insertion is performed between a node (E) and (D) when a failure occurs in channel ch.1 between a node (E) and (D), since the communication link by channel ch.1 between the transmission systems of another side which omitted the node (A) and the graphic display is continuable through a node (E), a squelch is not performed. Moreover, also in the case of a multicast, the squelch table which made the furthest node from a transmitting node the receiving node will be formed. Moreover, a MODIFAIDO squelch table is formed by this squelch table and the MODIFAIDO node ID. Moreover, if there is no failure between a transmitting node and the nearest node in this case, since a communication link is continuable at least between that transmitting node and the nearest node, a squelch in the meantime will not be performed.

[0104] Drawing 25 is a pass established-state explanatory view between nodes. Between channel ch.1 - ch.the node (A) by 8 and (B) by the side of the yeast (EAST) of a node (A), Between channel ch.9 - ch.the node (A) by 16 and (C), and between channel ch.17 - ch.the node (A) by 24 and (D), Between channel ch.1 - ch.the node (A) by 8 and (F) by the side of the waist (WEST) of a node (A), Between

channel ch.9 - ch.the node (A) by 16 and (E), and between channel ch.17 - ch.the node (A) by 24 and (D), The case where pass is set between channel ch.1 - ch.the nodes (E) by 8 and (F) by the side of the yeast (EAST) of a node (E) between channel ch.9 - ch.the node (C) by 16 and (E) by the side of the yeast (EAST) of a node (C) is shown.

[0105] Drawing 26 and drawing 27 are the explanatory views of a squelch table, for example, the ring topology [A] in the node (A) shown in drawing 26 shows that clockwise connection sequence is shown in a head and five nodes are connected to a self-node in the node (A) to right-hand side. A squelch table [A] about channel ch.1 moreover, the yeast (EAST) side of the direction (DIREC) of E->W A transmitting node B, receiving node A, and waist (WEST) side The yeast (EAST) side of the transmitting node A, the receiving node F, and the direction of E<-W A transmitting node A, receiving node B, and waist (WEST) side The transmitting node F and the receiving node A are shown. About channel ch.9 The yeast (EAST) side of the direction of E->W a transmitting node C, receiving node A, and waist (WEST) side In the yeast (EAST) side of the transmitting node A, the receiving node E, and the direction of E<-W, a transmitting node A, receiving node C, and waist (WEST) side shows the transmitting node E and the receiving node A. Moreover, about channel ch.17, a transmitting node and a receiving node serve as A and D also with the direction of E->W, and the direction of E<-W.

[0106] Moreover, for example, in the squelch table [D] of a node (E) shown in drawing 27 , about the direction of E->W of channel ch.9, and the direction of E<-W, a transmitting node and a receiving node serve as E and C, and a transmitting node and a receiving node serve as A and D similarly about the direction of E->W of channel ch.17, and the direction of E<-W.

[0107] Drawing 28 is an explanatory view at the time of two or more failures. Between a node (A) and (F) and a node (E), (D) The subring which shows the case where a failure occurs in between and consists of node (A) - (D) by the loop back in a node (A) and (D), The condition of having been divided into the subring which consists of a node (E) and (F) by the loop back in a node (E) and (F) is shown. Moreover, S shows the point of performing a squelch.

[0108] Drawing 29 and drawing 30 are the explanatory views of a MODIFAIDO squelch table. MODIFAIDO squelch table [A]- [F] which used and formed the MODIFAIDO node ID based on squelch table [A]- [F] shown in above-mentioned drawing 26 and drawing 27 is shown. For example, "B" of "1B" in a MODIFAIDO squelch table [A] is added in order that MODIFAIDO node ID=1 may make it intelligible to correspond to the node B of the squelch table [A] of drawing 26 . The same is said of other subscripts.

[0109] Moreover, ring topology [A]- [F] sets a self-node to 0, and expresses the ring topology shown by A-F by the MODIFAIDO node ID. Moreover, the control information which consists of the fur end node ID (FEID), the node status ST and Bridge Br, and Switch Sw from the change system unit HS to the main signal system unit HM at the time of failure generating shown in drawing 28 is shown.

[0110] For example, in a node (A), according to the failure by the side of the waist (WEST), although the loop back by reserved-circuit channel ch.25-ch.48 is formed by the waist (WEST) side, it will be identified that the transmitting node of the APS code changed from Node F to Node D. This node (D) is MODIFAIDO node ID=3, and the control information which consists of FEID (= 4), ST (= waist side switch), Br, and Sw of "0011", "11", "1", and "1" to the main signal system unit HM is transmitted from the change system unit HS.

[0111] Then, in the main signal system unit HM, it searches whether the node beyond MODIFAIDO node ID=4 is contained with reference to a MODIFAIDO squelch table [A]. In this case, since it is channel ch.1 and ch.9, that four or more MODIFAIDO nodes ID are contained judges with a squelch being required for this channel ch.1, ch, and 9. Moreover, since channel ch.17 become the loop back by reserved-circuit channel ch.41-ch.48, the communication link between this channel ch.node (A) by 17 and (D) is continued, and it turns out that a squelch is unnecessary.

[0112] Moreover, in a node (E), although the loop back is formed by the waist (WEST) side, since the transmitting node of the APS code changes with the failures by the side of yeast (EAST) from A to F, the node which a signal does not reach can identify that it is more than modification node ID=2. The control information which consists of FEID (= 1), ST (= waist side switch), Br, and Sw of "0001", "11", "1", and "1" is transmitted to the main signal system unit HM from the change system unit HS in that case. Then, in the main signal system unit HM, more than MODIFAIDO node ID=2 is searched with reference to a MODIFAIDO squelch table [E]. Thereby, since two or more MODIFAIDO nodes ID are contained in channel ch.9 and ch.17, it judges with a squelch being required.

[0113] Also in other nodes, the same actuation as the above-mentioned can perform a squelch judging with reference to a MODIFAIDO squelch table. Moreover, when divided into the subring by two or

more failure generating with which a node (E) belongs, for example, and the subring with which a node (D) belongs (for example, when it is the subring with which a node (D) belongs [a transmitting node or a receiving node] with reference to the MODIFAIDO squelch table [E] in a node (E)), it can judge with a squelch being required. Moreover, since the size comparison of the MODIFAIDO node ID can perform a squelch judging, the comparatively easy logical circuit shown in drawing 11 - drawing 14 can constitute a squelch judging circuit. Moreover, a squelch judging can be performed by hardware at high speed.

[0114]

[Effect of the Invention] As explained above, since each node from which this invention constitutes a ring transmission system can perform a squelch judging by the size comparison of a MODIFAIDO node identification number including a MODIFAIDO squelch table and the squelch judging section at the time of failure generating, it has the advantage whose high-speed judgment by hardware is attained while it can realize the squelch judging section by the comparatively easy comparison circuit. Moreover, by sending out a ring TOBOROJI frame and inserting the identification number of each node, the MODIFAIDO squelch table changed into the MODIFAIDO node identification number which built the ring topology, and formed the squelch table accompanying pass setting out between nodes based on it, and made the self-node the reference value can be formed, and the above-mentioned squelch judging can be performed by the size comparison of a MODIFAIDO node identification number. Moreover, by the squelch to the drop channel or intact circuit of a reserved circuit, there is an advantage which can prevent generating of incorrect connection certainly.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The identification number of a transmitting node (node which inserts a signal), and the identification number of a receiving node (node which drops a signal) are used for the squelch table prepared in each node at the time of communication channel setting out between nodes, and it forms them in a channel response at it. Since a processor will perform retrieval processing of a squelch table for the node to which a signal cannot reach a channel response based on an identification number and collating of an identification number and a comparison will be performed in detail when software performs all control that performs squelch insertion using this squelch table at the time of two or more failure generating, there is a problem to which the time amount which a squelch judging takes becomes long.
[0022] moreover, the ring transmission system of a BLSR method with 1200km of transmission-line length by the optical fiber, and 16 nodes -- setting -- the loop back for the failure relief from failure detection -- present -- to be 50 or less ms is demanded till the completion of a change of business and a preliminary change. Moreover, in the case of two or more failures, to be 100 or less ms is demanded. Therefore, since it is necessary to perform change processing at high speed and squelch processing is needed at the time of two or more failures, after failure detection also needs to accelerate this squelch processing.
[0023] Then, it is possible to consider all squelch processings as the configuration which can be performed by hardware. However, since a squelch table stores a node identification number corresponding to a channel response and the transceiver direction of a signal, this squelch table and the circuitry which collates and compares the identification number of the node which a signal cannot reach according to two or more failures become very complicated and large-scale, and implementation has a difficult problem. This invention aims at attaining improvement in the speed of squelch processing, without increasing circuit magnitude.

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, since each node from which this invention constitutes a ring transmission system can perform a squelch judging by the size comparison of a MODIFAIDO node identification number including a MODIFAIDO squelch table and the squelch judging section at the time of failure generating, it has the advantage whose high-speed judgment by hardware is attained while it can realize the squelch judging section by the comparatively easy comparison circuit. Moreover, by sending out a ring TOBOROJI frame and inserting the identification number of each node, the MODIFAIDO squelch table changed into the MODIFAIDO node identification number which built the ring topology, and formed the squelch table accompanying pass setting out between nodes based on it, and made the self-node the reference value can be formed, and the above-mentioned squelch judging can be performed by the size comparison of a MODIFAIDO node identification number. Moreover, by the squelch to the drop channel or intact circuit of a reserved circuit, there is an advantage which can prevent generating of incorrect connection certainly.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the ring topology construction explanatory view of the example of this invention.
[Drawing 2] It is the explanatory view of squelch table formation.
[Drawing 3] It is the explanatory view of squelch table formation.
[Drawing 4] It is the explanatory view of the MODIFAIDO squelch table of the example of this invention.
[Drawing 5] It is the explanatory view of the unit configuration of a node.
[Drawing 6] It is the change actuation explanatory view of the node at the time of failure generating.
[Drawing 7] It is the control function block diagram of a node.
[Drawing 8] It is the explanatory view of a squelch judging.
[Drawing 9] It is the explanatory view of a squelch judging.
[Drawing 10] It is the explanatory view of squelch processing.
[Drawing 11] It is the explanatory view of the yeast side squelch judging section.
[Drawing 12] It is the explanatory view of the yeast side squelch judging section.
[Drawing 13] It is the explanatory view of the waist side squelch judging section.
[Drawing 14] It is the explanatory view of the waist side squelch judging section.
[Drawing 15] It is the explanatory view of the point inserting [squelch].
[Drawing 16] It is the flow explanatory view of the signal at the time of the yeast side loop back.
[Drawing 17] It is the flow explanatory view of the signal at the time of the waist side loop back.
[Drawing 18] It is the explanatory view of squelch processing to a reserved-circuit channel.
[Drawing 19] It is the explanatory view of the squelch processing in a switching node.
[Drawing 20] It is the explanatory view of squelch processing to a reserved-circuit channel.
[Drawing 21] It is the explanatory view of squelch processing to a reserved-circuit channel.
[Drawing 22] It is an explanatory view at the time of service selector setting out.
[Drawing 23] It is the explanatory view of the squelch table at the time of service selector setting out.
[Drawing 24] It is the explanatory view of the squelch table at the time of service selector setting out.
[Drawing 25] It is a pass established-state explanatory view between nodes.
[Drawing 26] It is the explanatory view of a squelch table.
[Drawing 27] It is the explanatory view of a squelch table.
[Drawing 28] It is an explanatory view at the time of two or more failures.
[Drawing 29] It is the explanatory view of a MODIFAIDO squelch table.
[Drawing 30] It is the explanatory view of a MODIFAIDO squelch table.
[Drawing 31] It is the relief explanatory view of a failure.
[Drawing 32] It is the explanatory view of an APS protocol.
[Drawing 33] They are a header and K1, and a K2 byte explanatory view.
[Drawing 34] It is a squelch actuation explanatory view.
[Drawing 35] It is the judgment explanatory view of a single failure and two or more failures.
[Description of Notations]
(A) - (D) Node
RL Ring transmission line
ID Node identification number

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CLAIMS

[Claim(s)]
[Claim 1] The compound (B-2-3-2) which has a urethane bond among the compounds which have the vinyl ether radical which is characterized by providing the following, and which is classified into the above (B-2-3) is the ring transmission system of the bidirectional line switch ring method which connected two or more nodes according to the ring transmission line. Said each node is the MODIFAIDO squelch table in which making the MODIFAIDO node identification number which shows the sequence connected to said ring transmission line on the basis of the self-node, and the identification number of each node correspond, and showing between the communication link nodes by this MODIFAIDO node identification number. The MODIFAIDO node identification number which shows between the communication link nodes stored in this MODIFAIDO squelch table The squelch judging section which performs a squelch judging by the size comparison with the MODIFAIDO node identification number of the node which the signal by failure generating does not reach
[Claim 2] The ring transmission system according to claim 1 characterized by providing the following. Said each node is a control-system unit which manages ring TOBOROJI and a squelch table. The change system unit which performs an automatic protection change protocol and performs a change demand by transmission-line failure detection, signal quality degradation detection, and both-system main signal system unit omission detection This main signal system unit is a line switch which changes by the change demand from said change system unit including the main signal system unit. The MODIFAIDO squelch table formed based on the ring topology and squelch table of said control-system unit, the squelch judging section which performs a squelch judging with reference to this MODIFAIDO squelch table, and the squelch activation section which performs a squelch by the squelch judging result
[Claim 3] In the squelch approach of the ring transmission system of the bidirectional line switch ring method which connected two or more nodes according to the ring transmission line When building a ring topology required in order to form a squelch table, the node which performs ring topology construction directions The node which sent out the ring topology frame which added the self-node identification number to the head, and received this frame Based on the order of a node identification number inserted in the frame which inserted and transmitted the self-node identification number in order of reception, and took a round of said ring transmission line, each node The squelch approach of the ring transmission system characterized by including the process in which ring TOBOROJI is built by making the identification number of a self-node into a head.
[Claim 4] Said each node is the squelch approach of the ring transmission system according to claim 3 characterized by including the process which forms the MODIFAIDO squelch table which gave the MODIFAIDO node identification number according a self-node to the number of ascending order or descending order as a reference value, and changed the node identification number of said squelch table into said MODIFAIDO node identification number based on said ring topology.
[Claim 5] The squelch approach of the ring transmission system according to claim 4 which sets said MODIFAIDO node identification number of said self-node to 0, and is characterized by giving a MODIFAIDO node identification number to ascending order according to the clockwise rotation or the counter clockwise order of connection by said ring transmission line.
[Claim 6] The squelch approach of the ring transmission system according to claim 4 or 5 characterized by including the process in which identify the node which a signal cannot reach and the size comparison with the MODIFAIDO node identification number of this node and the MODIFAIDO node identification number of said MODIFAIDO squelch table performs a squelch judging when a failure occurs between said nodes.

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[Claim 7] Claim 4 characterized by judging with a squelch being required when it identifies that a transmitting node or a receiving node exists in a different subring from the subring to which a self-node belongs among the subrings formed of two or more failure generating with reference to said MODIFAIDO squelch table, 5, or the squelch approach of a ring transmission system given in six.
[Claim 8] The squelch approach of the ring transmission system of the bidirectional line switch ring method which connected two or more nodes according to the ring transmission line characterized by providing the following said ring transmission line -- present -- business -- a circuit and a reserved circuit -- containing -- said each node -- the idle state of forward always The process in which set up the node status which shows the passthrough condition at the time of failure generating, and the switching condition by the side of yeast and the waist, and the squelch judging to a reserved-circuit channel is performed according to this node status
[Claim 9] The squelch approach of the ring transmission system according to claim 8 characterized by including the process in which a squelch is performed before time-slot assignment to all the drop side of a reserved-circuit channel when said node status shows said passthrough condition.
[Claim 10] The squelch approach of the ring transmission system according to claim 8 characterized by including the process in which perform a squelch before time-slot assignment to all the drop side of said reserved-circuit channel, and a squelch is performed to the input side and output side of a node of a reserved-circuit channel while a MODIFAIDO node identification number performs a squelch judging with reference to a MODIFAIDO squelch table, when said node status shows said switching condition.
[Claim 11] The squelch approach of the ring transmission system characterized by including the process in which a squelch is compulsorily performed to an intact circuit in the squelch approach of the ring transmission system of the bidirectional line switch ring method which connected two or more nodes according to the ring transmission line at the time of the judgment which needs a squelch according to failure generating.
[Claim 12] The squelch approach of the ring transmission system according to claim 4, 5, 6, or 11 characterized by storing a self-node identification number or the MODIFAIDO node identification number of a self-node to the intact circuit channel of said squelch table or a MODIFAIDO squelch table.

[Claim 13] Said each node is the squelch approach of the ring transmission system according to claim 12 characterized by including the process notified to a control-system unit except for the compulsory squelch to said intact circuit channel among the squelch judging results in the main signal system unit.

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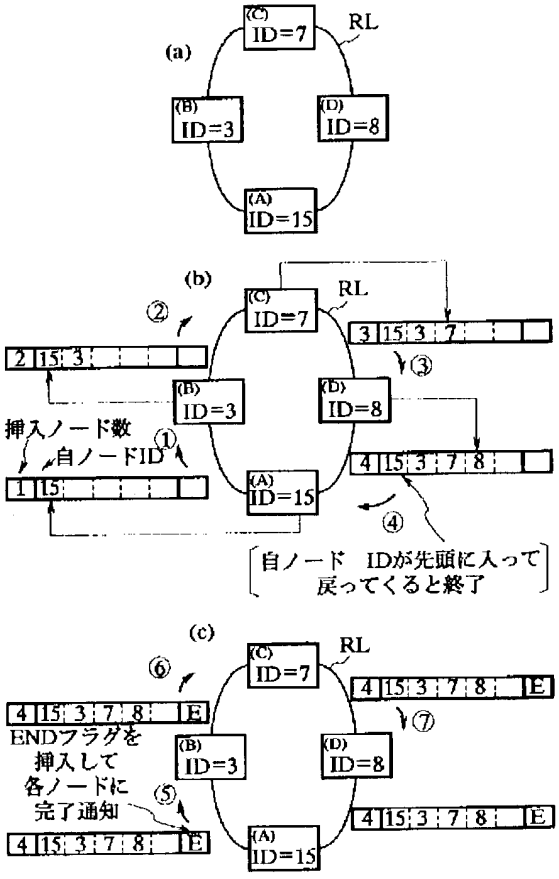
DRAWINGS

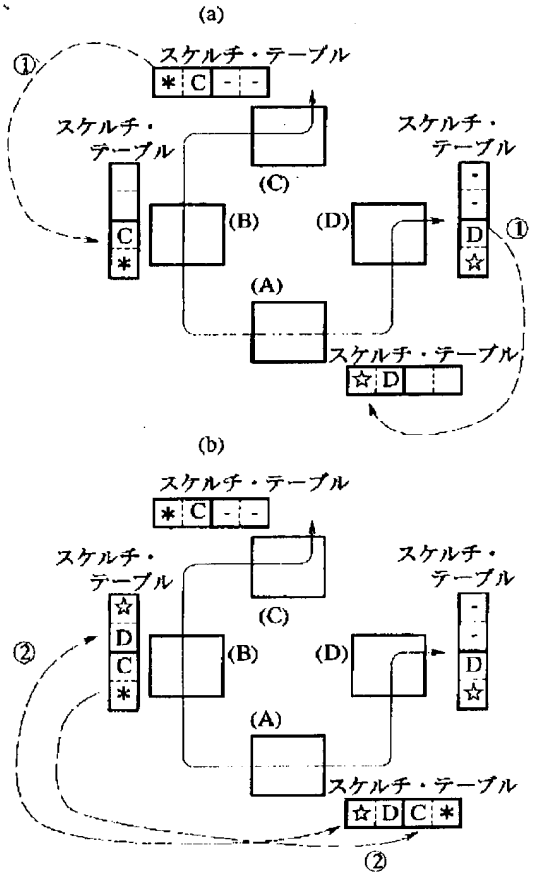
[Drawing 1]

本発明の実施例のリング・トポロジー構築説明図



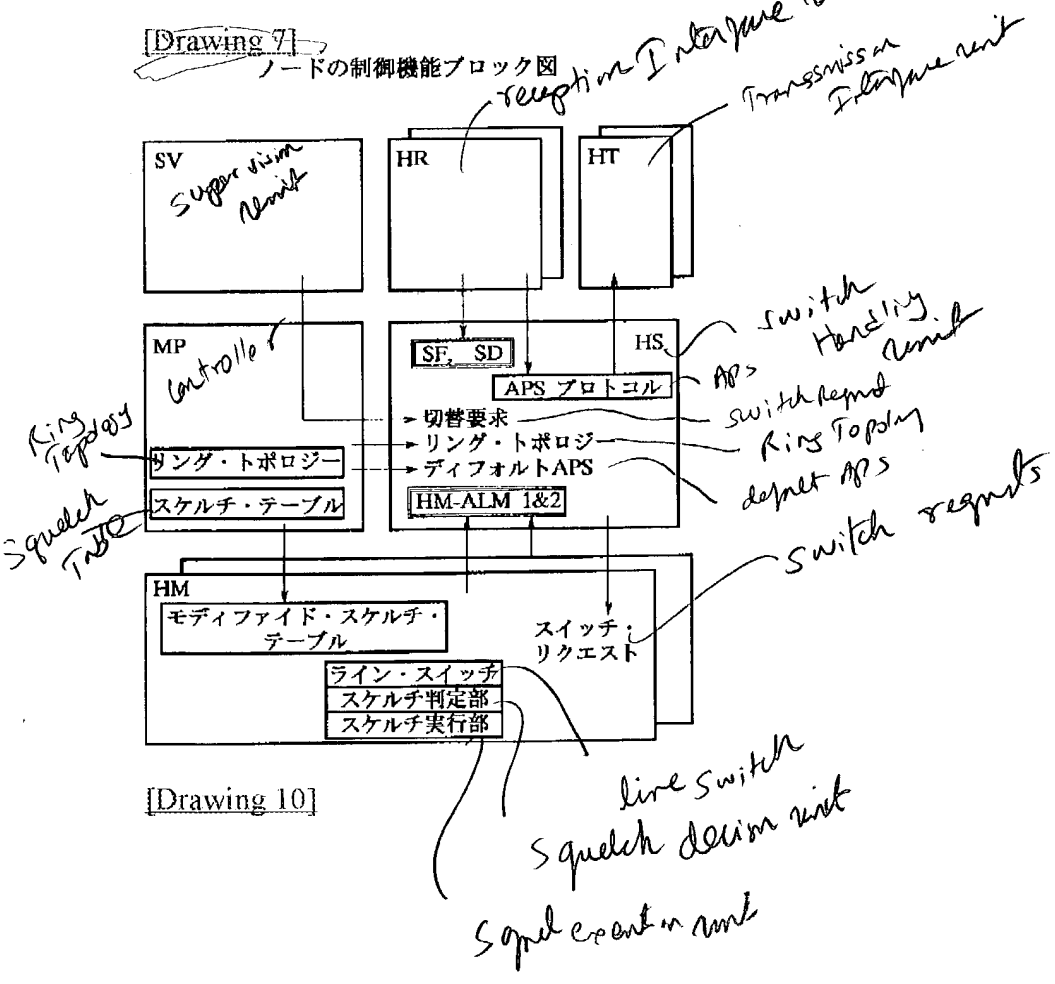
[Drawing 2]

スケルチ・テーブル形成の説明図



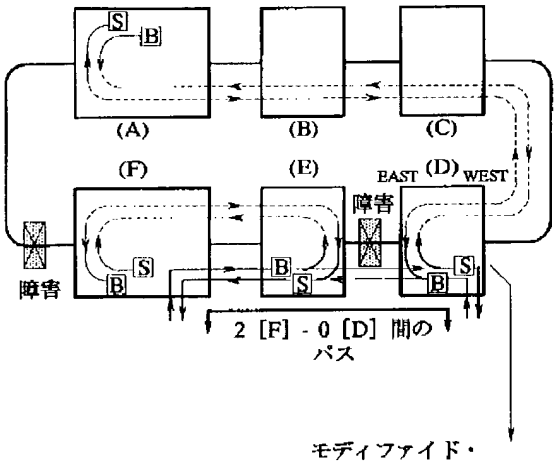
[Drawing 7]

ノードの制御機能ブロック図



[Drawing 10]

スケルチ処理の説明図

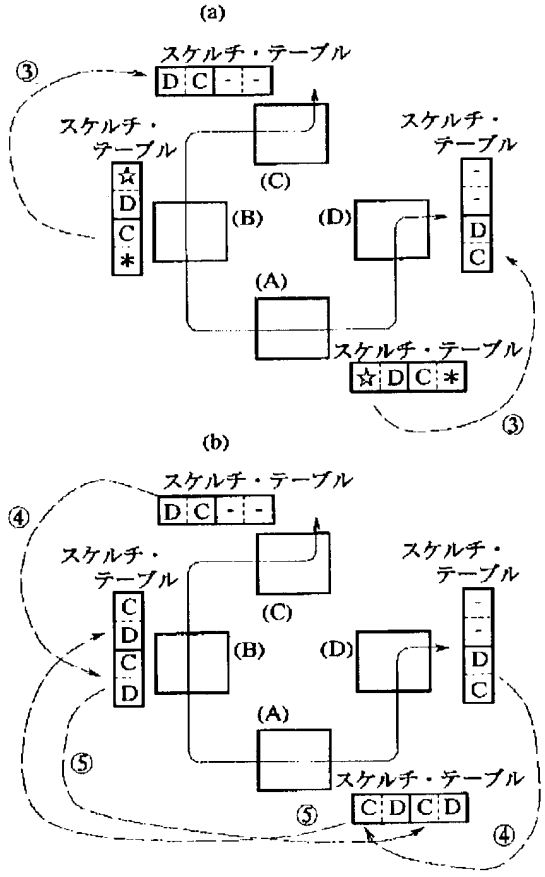


モディファイド・
スケルチ・テーブル [D]

	EAST			WEST			DIREC
ch. 1	Sw	2	0	0	0	Br	E ⇨ W
	Br	2	0	0	0	Sw	E ⇦ W
:							:

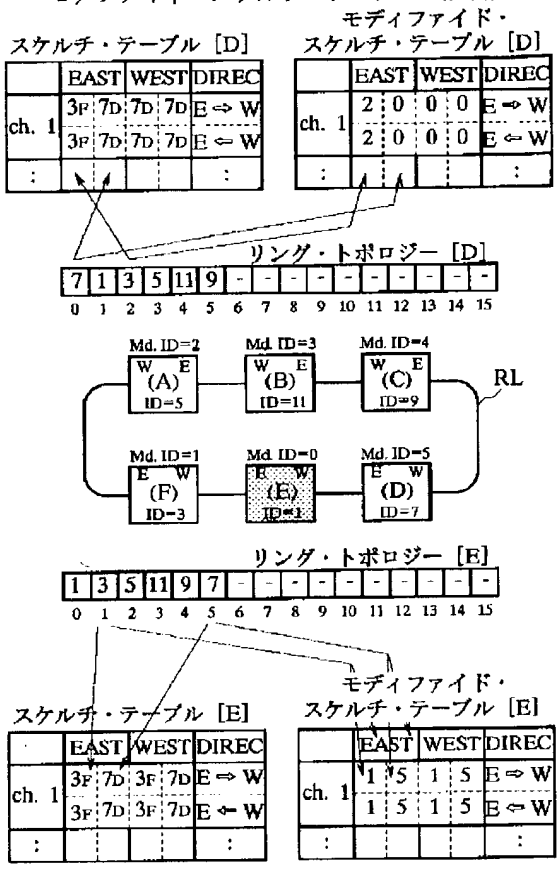
[Drawing 3]

スケルチ・テーブル形成の説明図

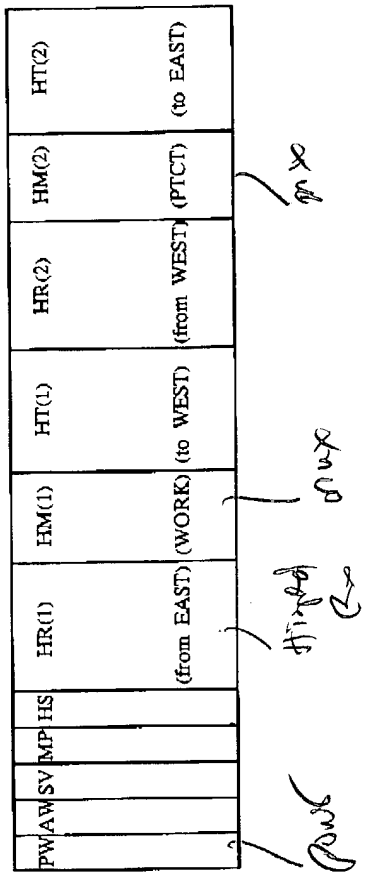


[Drawing 4]

本発明の実施例の
モデファイド・スケルチ・テーブルの説明図

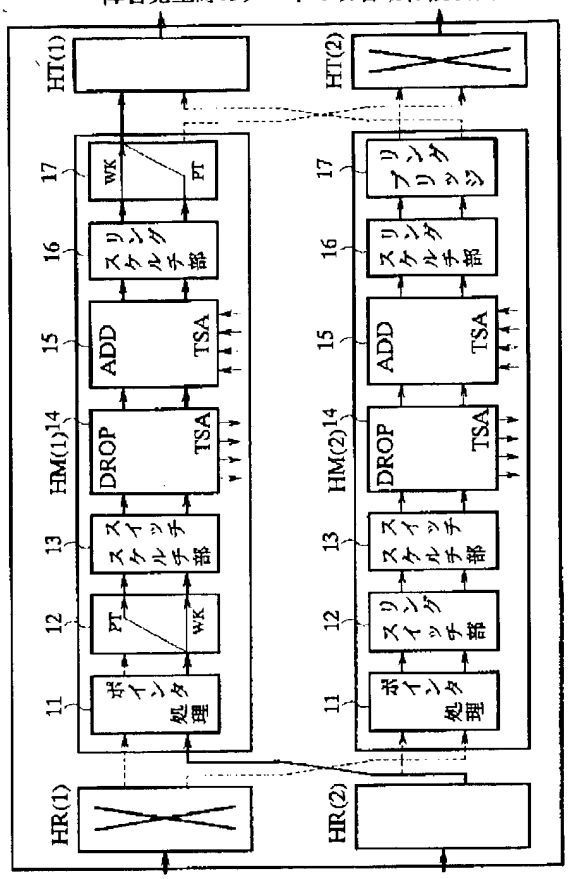


[Drawing 5]
ノードのユニット構成の説明図



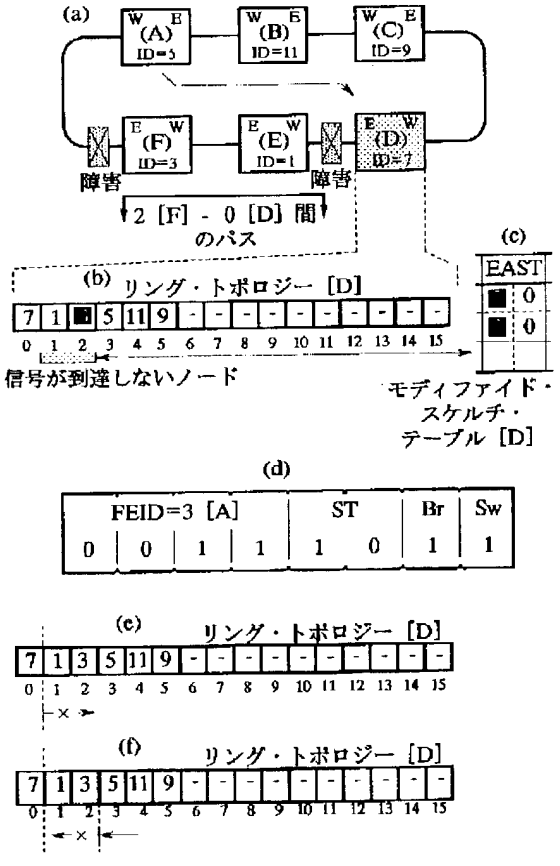
[Drawing 6]

障害発生時のノードの切替動作説明図



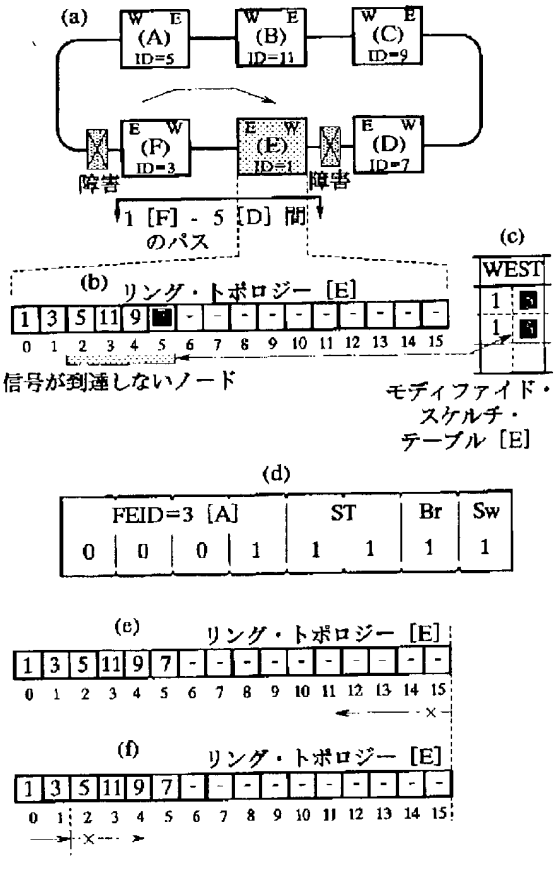
[Drawing 8]

スケルチ判定の説明図



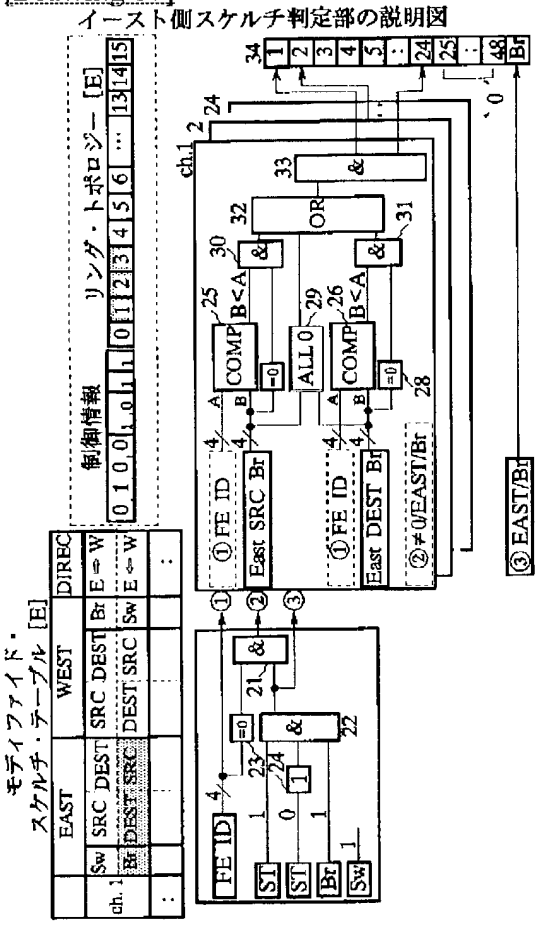
[Drawing 9]

スケルチ判定の説明図



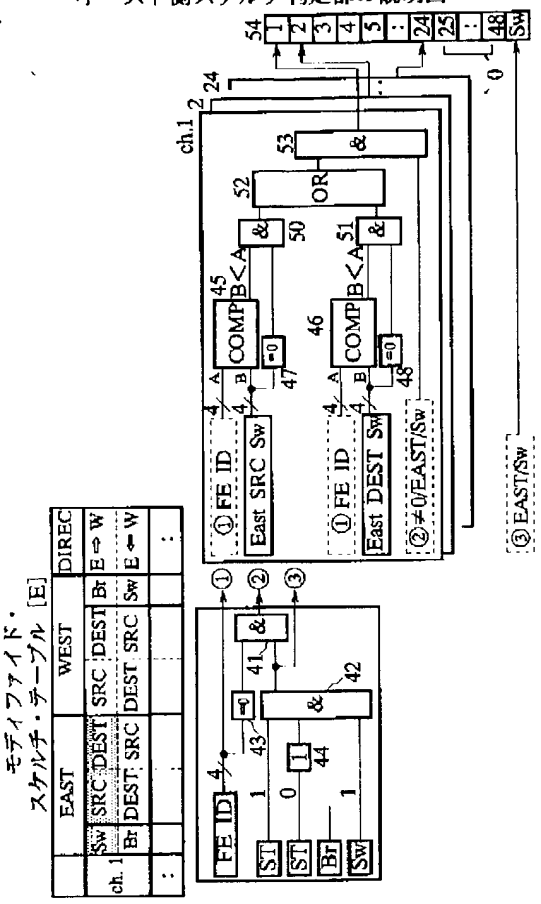
[Drawing 11]

イースト側スケルチ判定部の説明図



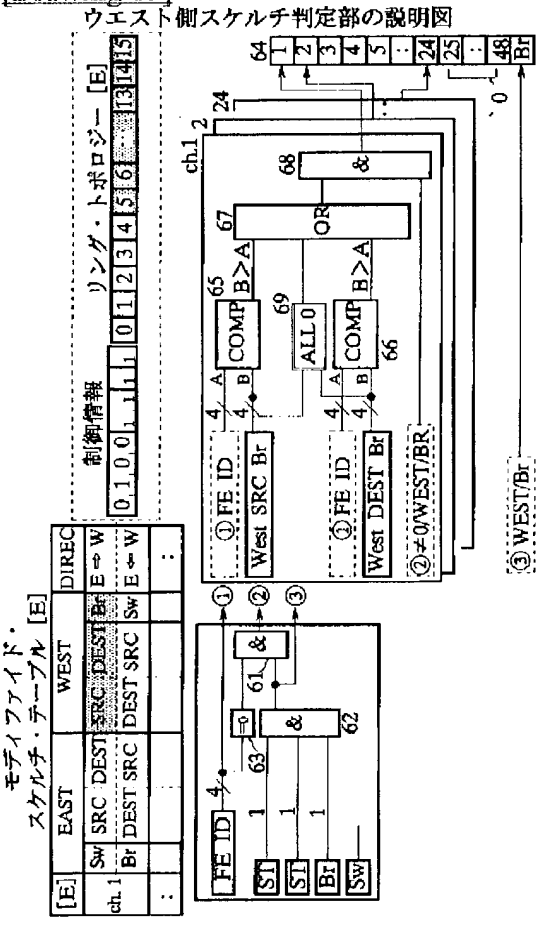
[Drawing 12]

イースト側スケルチ判定部の説明図



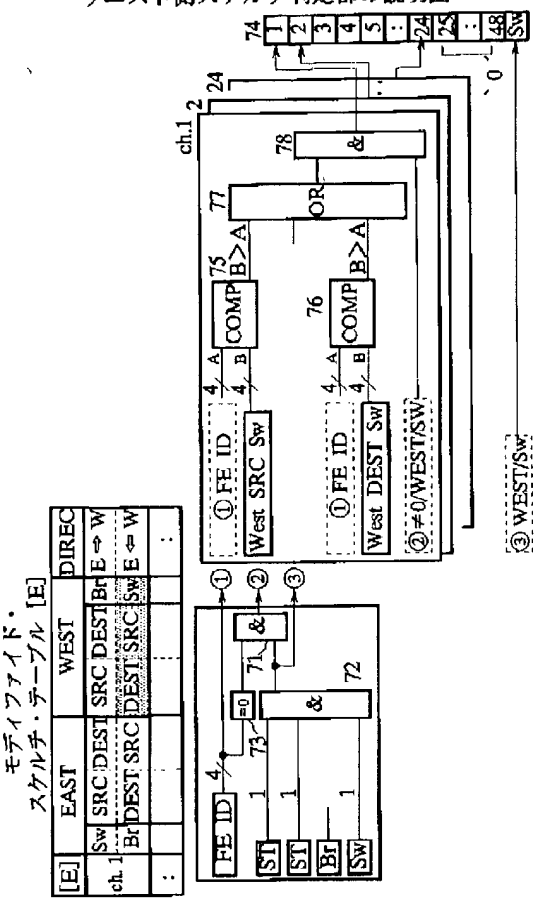
[Drawing 13]

ウエスト側スケルチ判定部の説明図



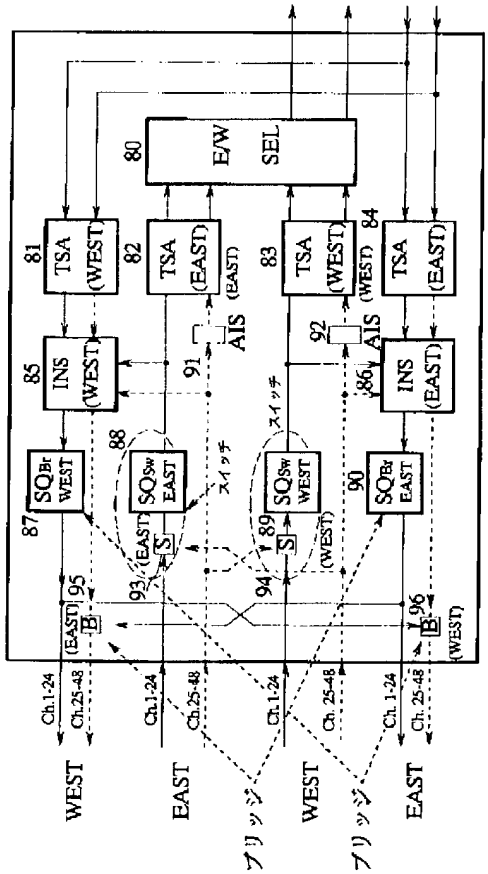
[Drawing 14]

ウエスト側スケルチ判定部の説明図



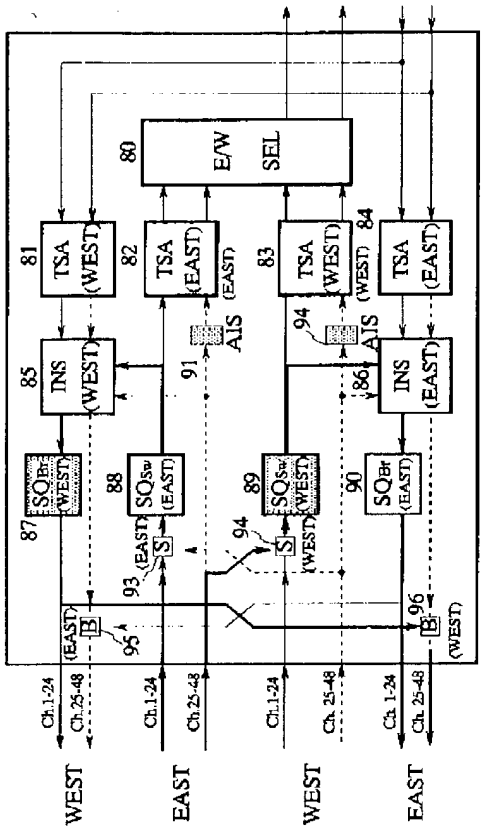
[Drawing 15]

スケルチ挿入点の説明図



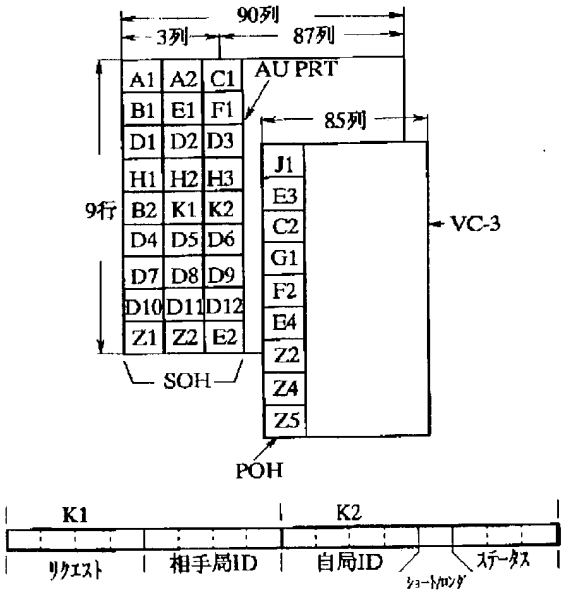
[Drawing 16]

イースト側ループバック時の
信号の流れ説明図



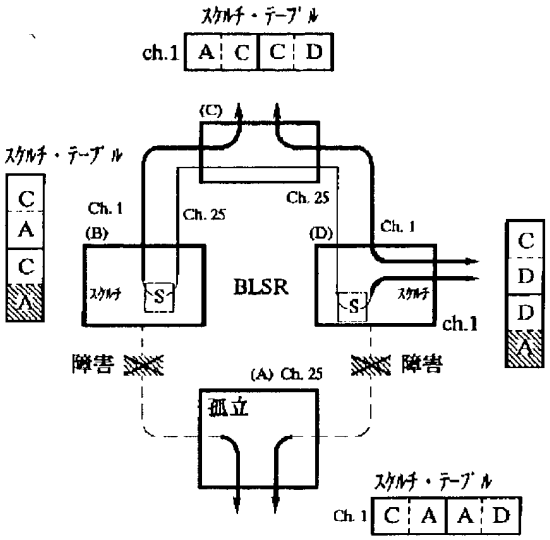
[Drawing 33]

ﾍｯﾀﾞ及びK1, K2ﾊﾞｲﾄの説明図



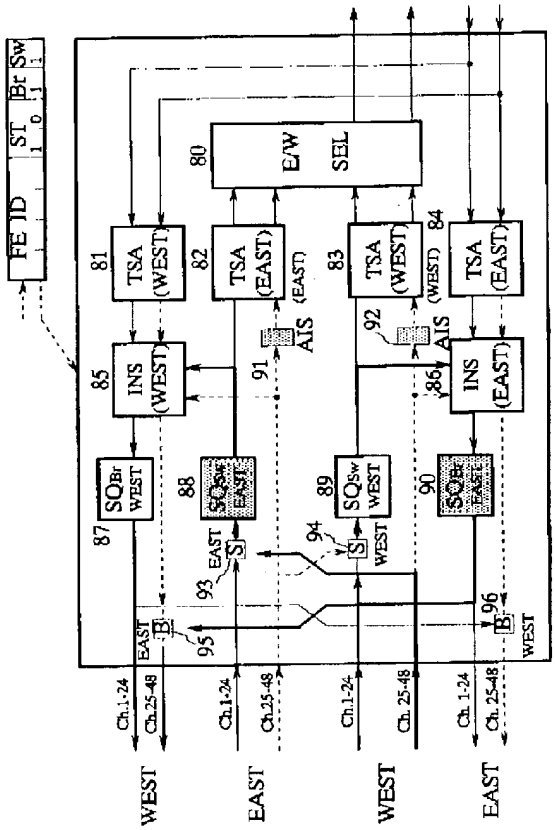
[Drawing 34]

スケルチ動作説明図



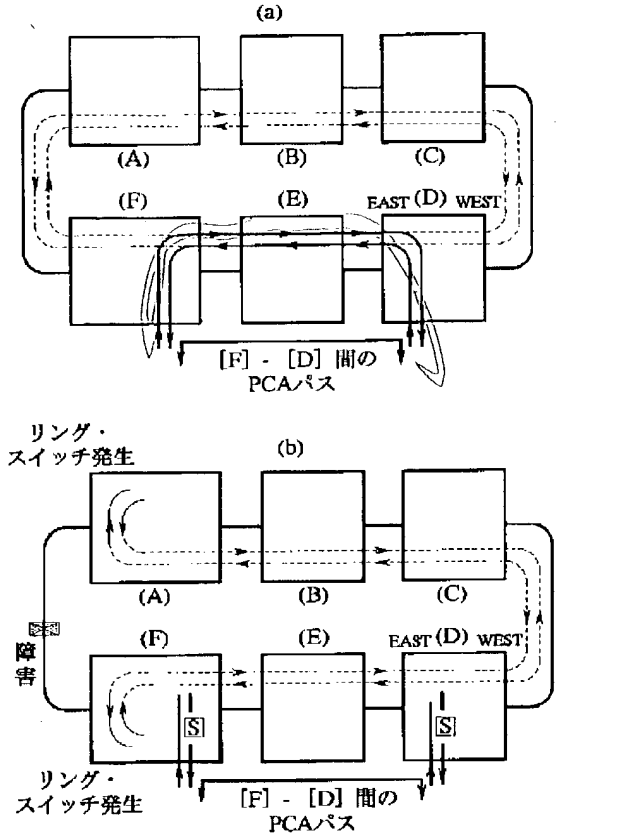
[Drawing 17]

ウエスト側ループバック時の
信号の流れ説明図



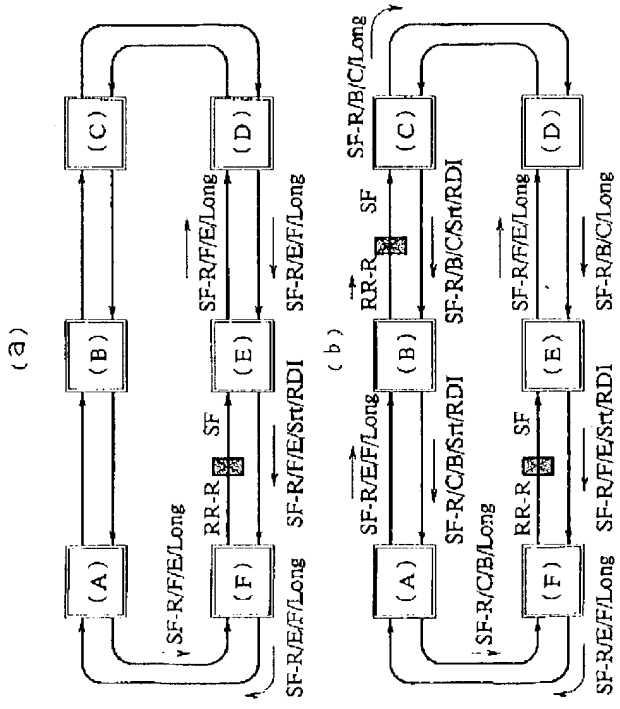
[Drawing 18]

予備回線チャネルに対する
スケルチ処理の説明図



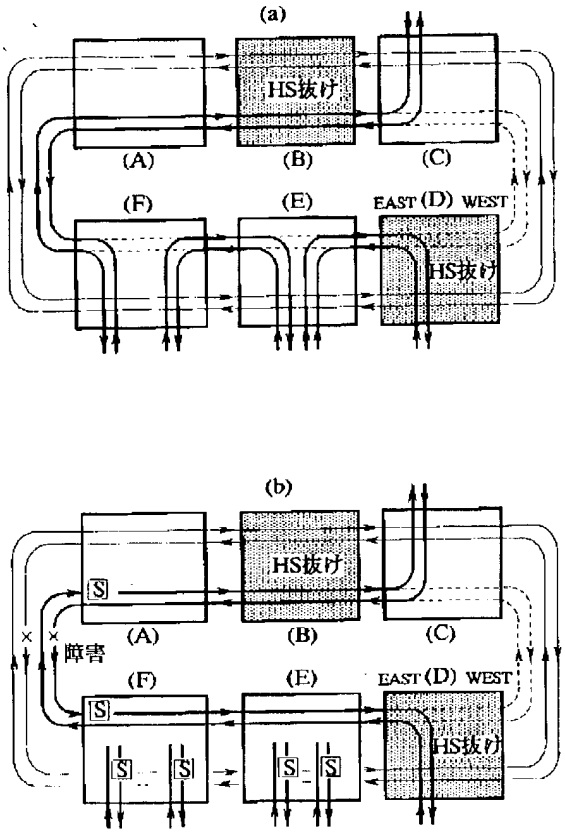
[Drawing 35]

単一障害と複数障害との判定説明図



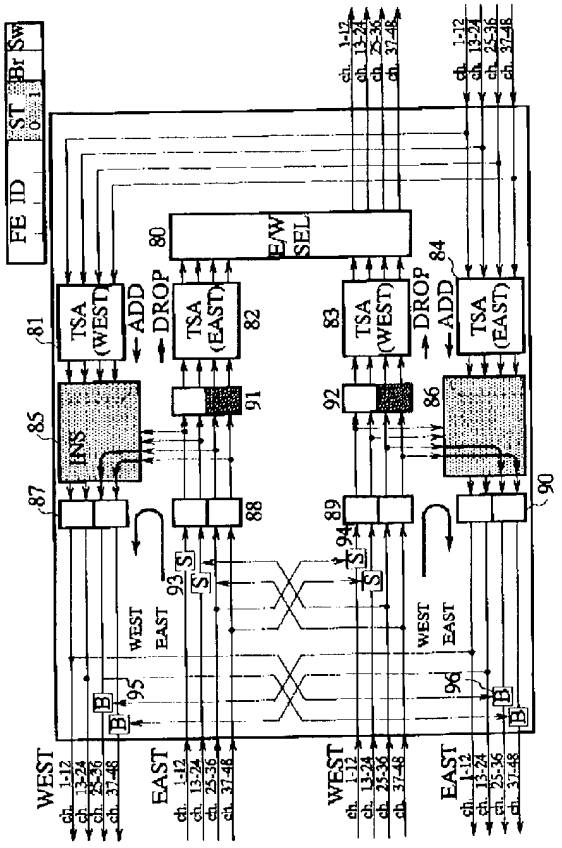
[Drawing 19]

スイッチング・ノードに於ける
スケルチ処理の説明図



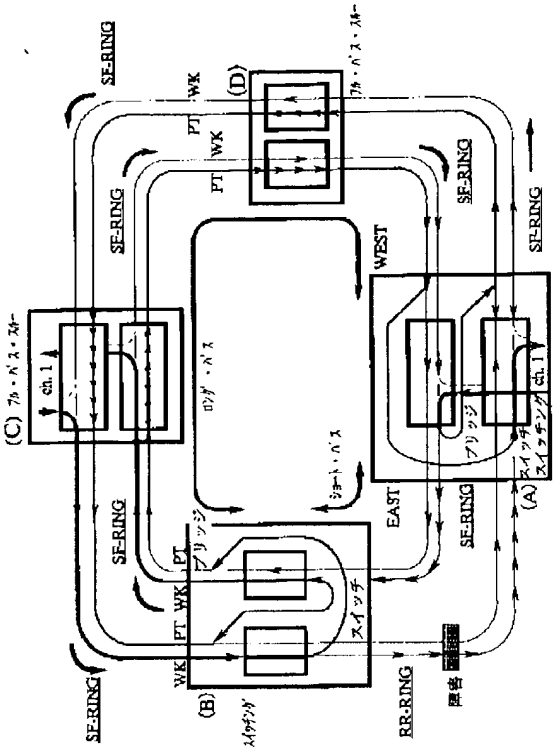
[Drawing 20]

予備回線チャネルに対する
スケルチ処理の説明図



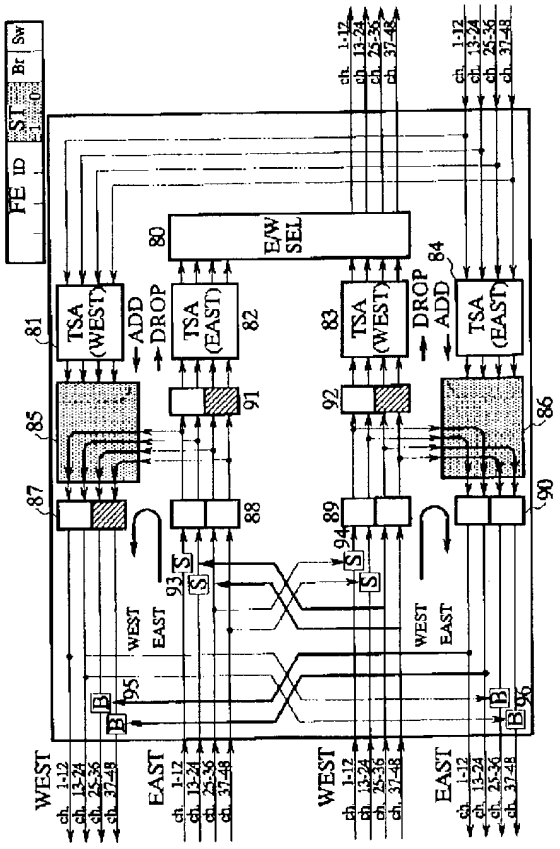
[Drawing 32]

APSプロトコルの説明図



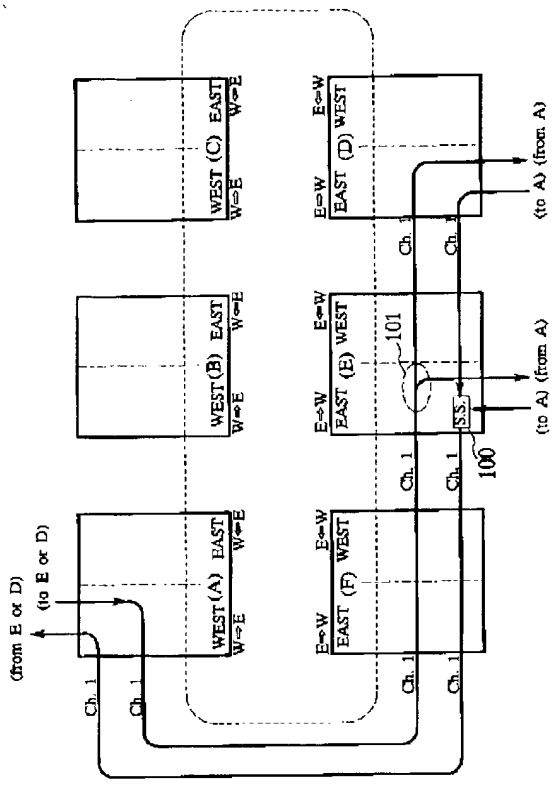
[Drawing 21]

予備回線チャネルに対する
スケルチ処理の説明図



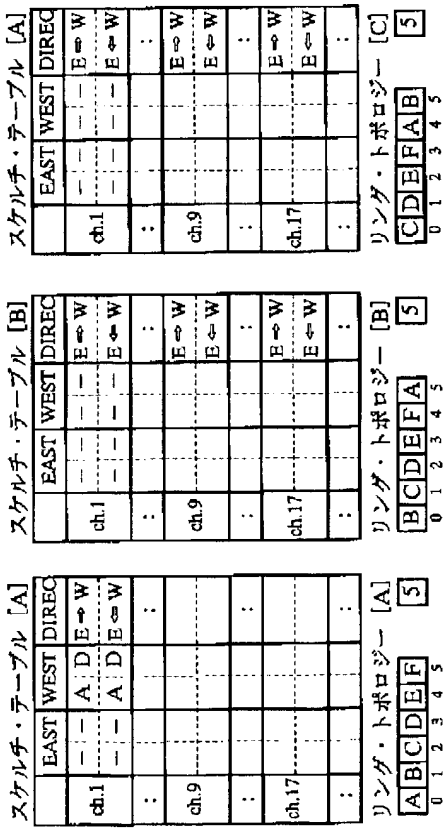
[Drawing 22]

サービス・セレクタ設定時の説明図



[Drawing 23]

サービス・セレクタ設定時の
スケルチ・テーブルの説明図



[Drawing 24]

サービス・セレクタ設定時の
スケルチ・テーブルの説明図

スケルチ・テーブル [F]

	EAST	WEST	DIREC
ch.1	A D	A D	E ⇔ W
	A D	A D	E ⇔ W
:			:
ch.9			E ⇒ W
			E ⇐ W
:			:
ch.17			E ⇒ W
			E ⇐ W
:			:

リング・トポロジー [F] 5

F	A	B	C	D	E
0	1	2	3	4	5

スケルチ・テーブル [E]

	EAST	WEST	DIREC
ch.1	A D	A D	E ⇔ W
	A D	A D	E ⇔ W
:			:
ch.9			E ⇒ W
			E ⇐ W
:			:
ch.17			E ⇒ W
			E ⇐ W
:			:

リング・トポロジー [E] 5

E	F	A	B	C	D
0	1	2	3	4	5

スケルチ・テーブル [D]

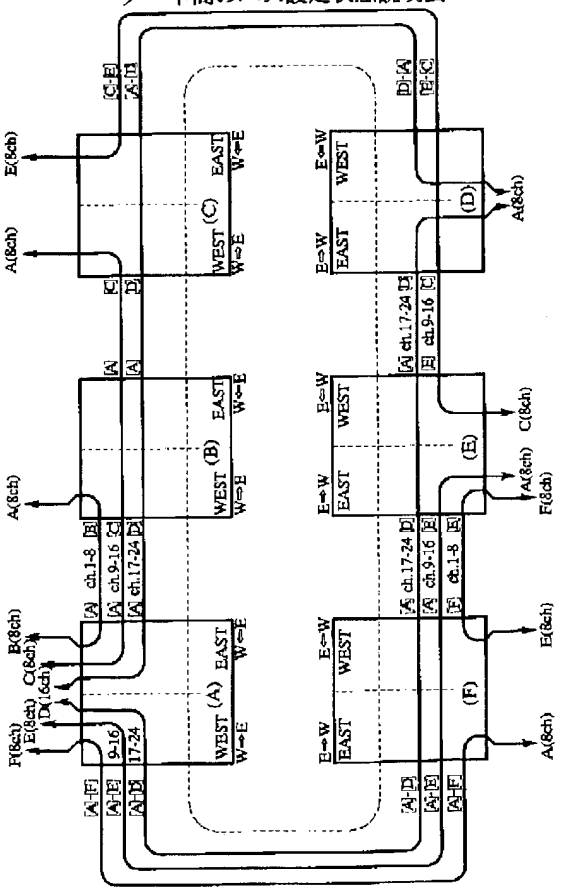
	EAST	WEST	DIREC
ch.1	A D	— —	E ⇔ W
	A D	— —	E ⇐ W
:			:
ch.9			E ⇔ W
			E ⇐ W
:			:
ch.17			E ⇔ W
			E ⇐ W
:			:

リング・トポロジー [D] 5

D	E	F	A	B	C
0	1	2	3	4	5

[Drawing 25]

ノード間のパス設定状態説明図



[Drawing 26]

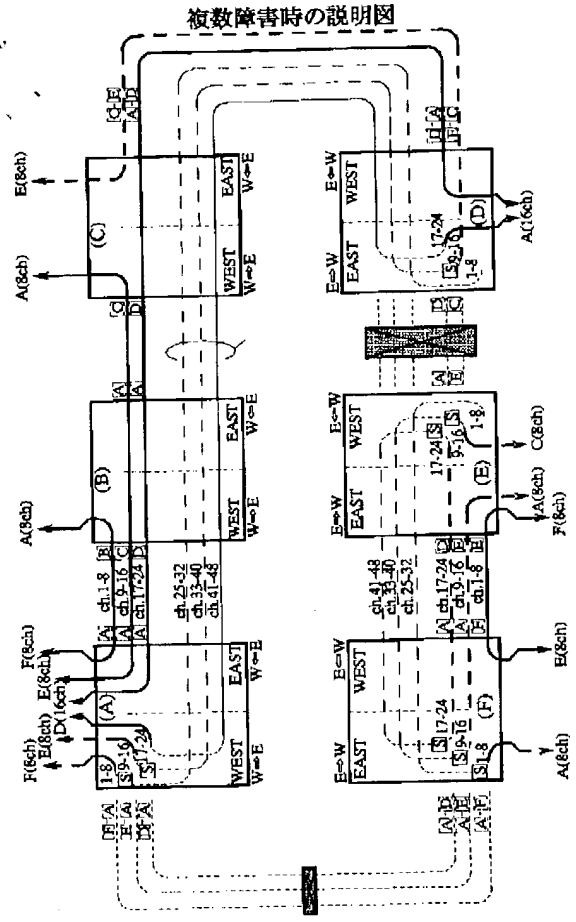
スケルチ・テーブルの説明図

[Drawing 27]

スケルチ・テーブルの説明図

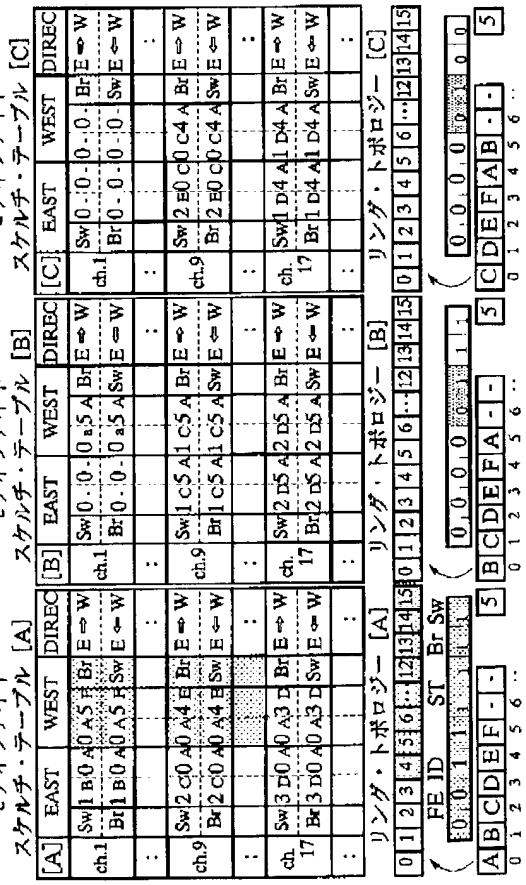
[Drawing 28]

複数障害時の説明図



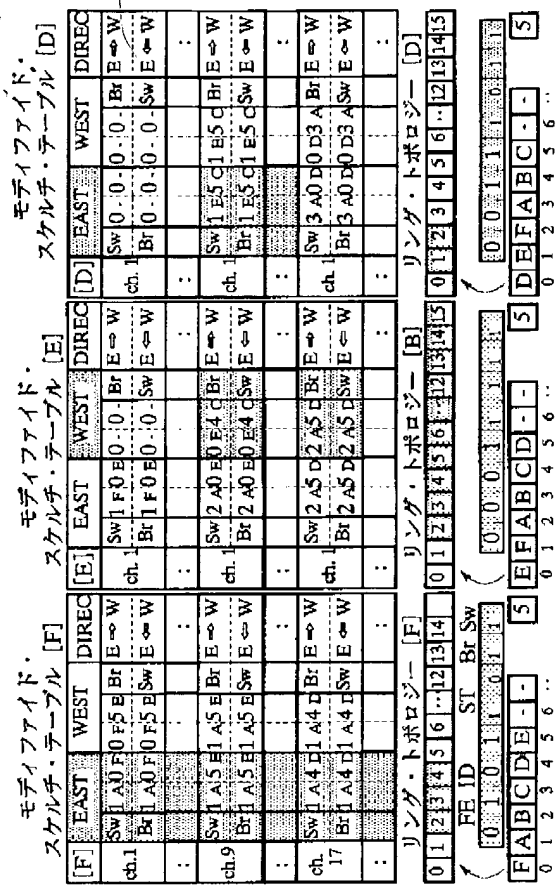
[Drawing 29]

モディファイド・スケルチ・テーブル説明図



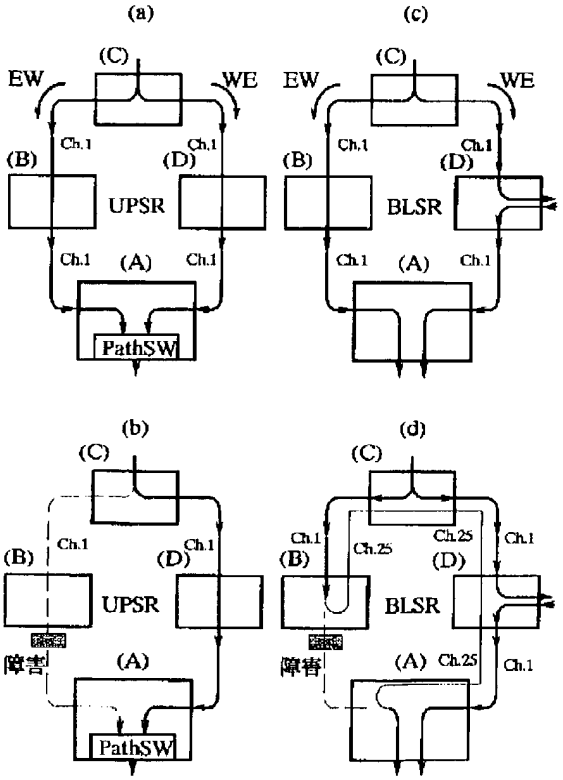
[Drawing 30]

モディファイド・スケルチ・テーブルの説明図



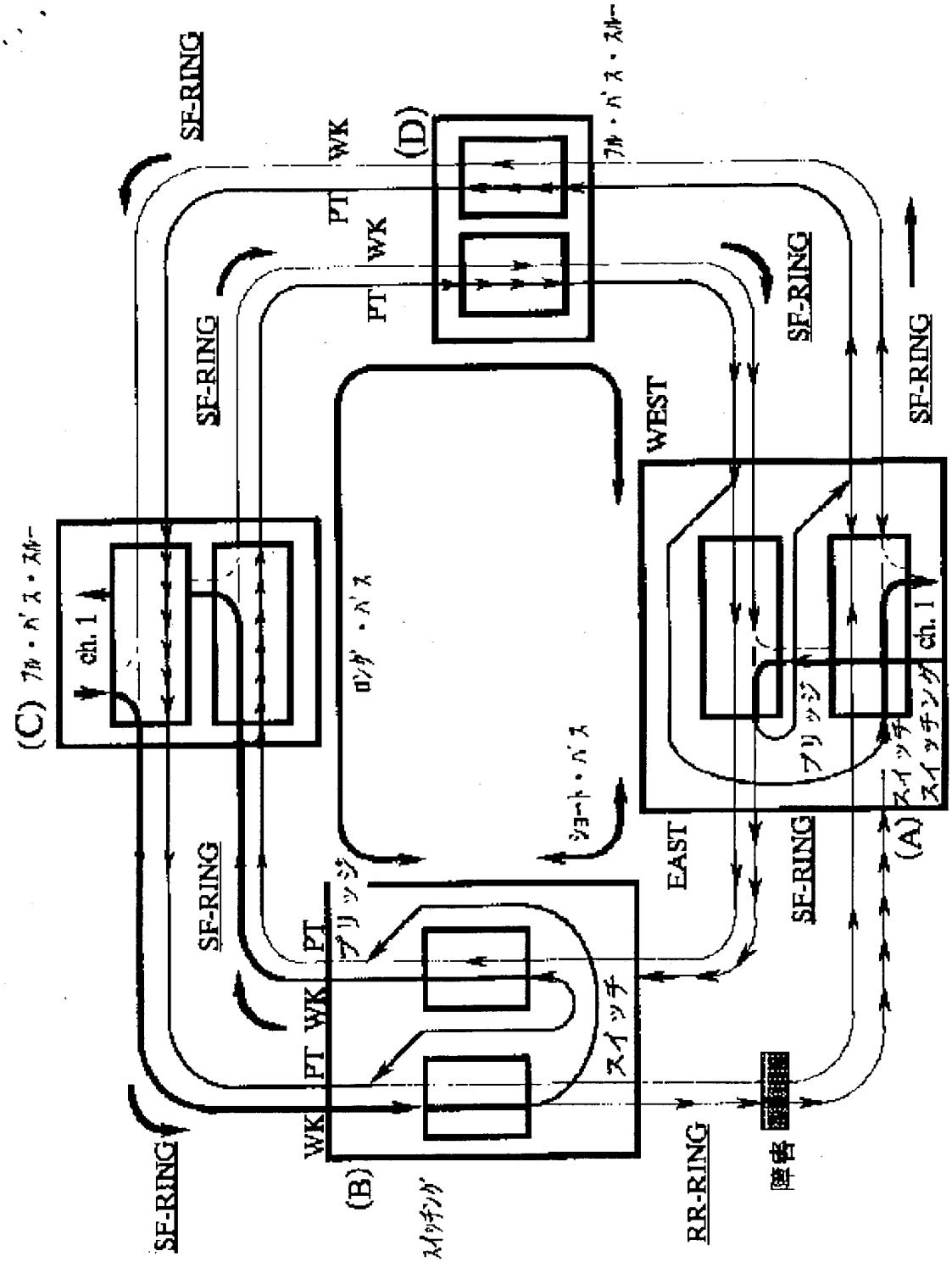
[Drawing 31]

障害の救済説明図



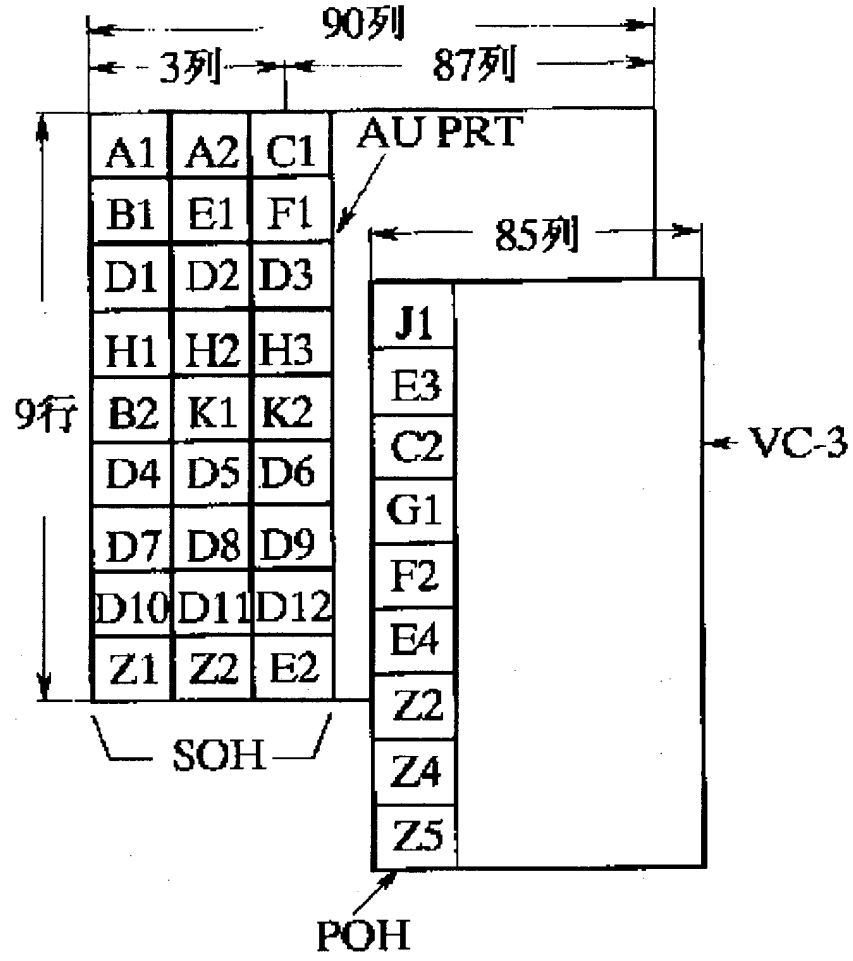
[Translation done.]

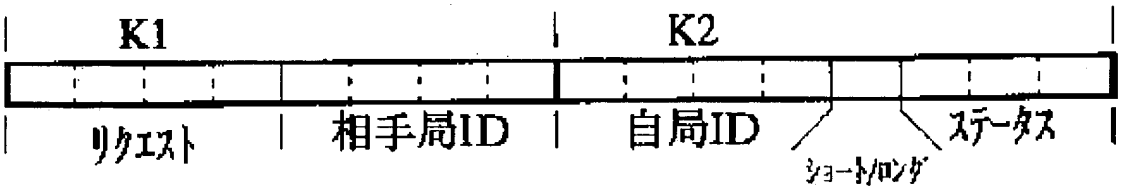
APSプロトコルの説明図



DRAW-32

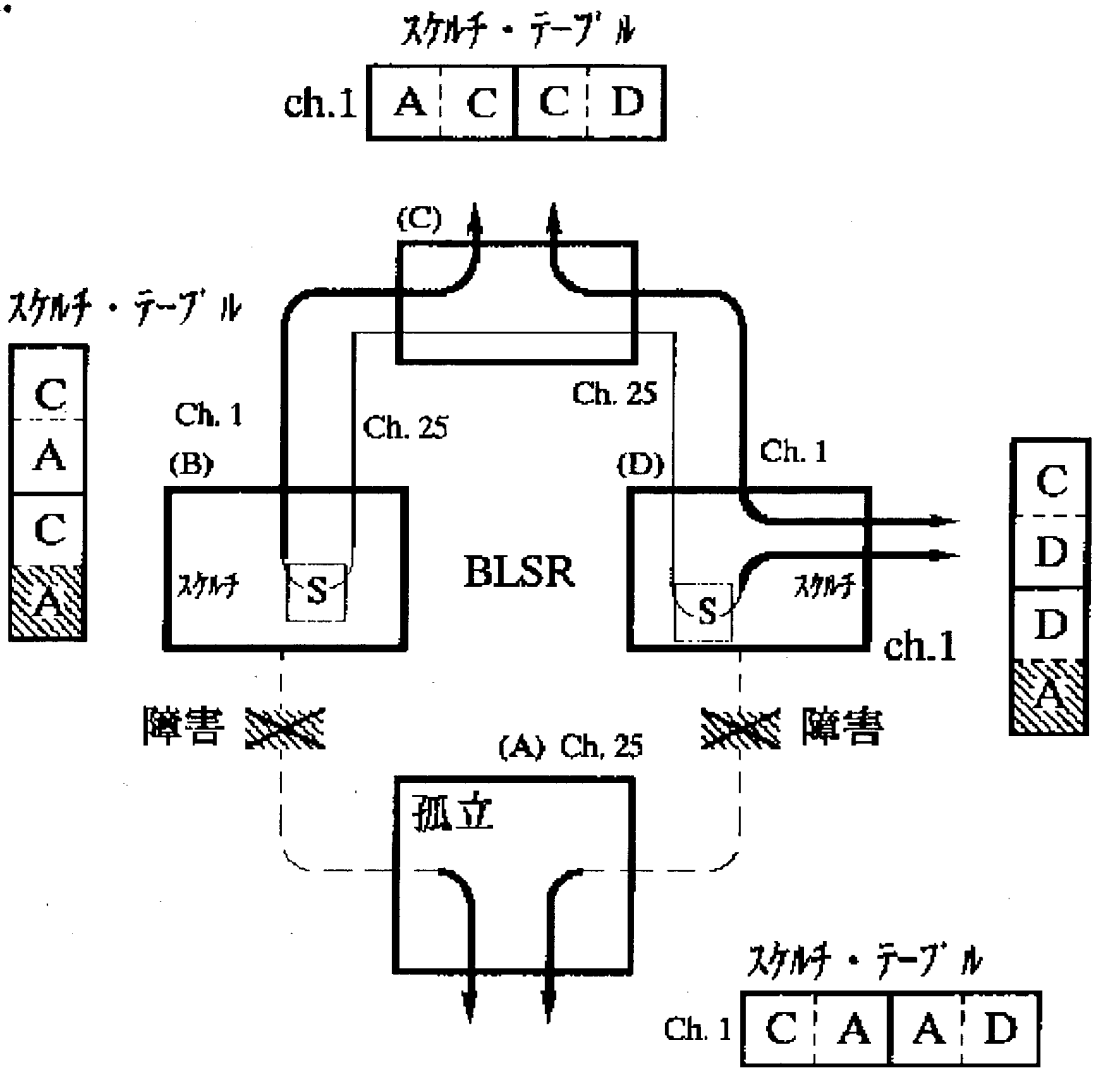
ヘッダ 及びK1, K2バイトの説明図





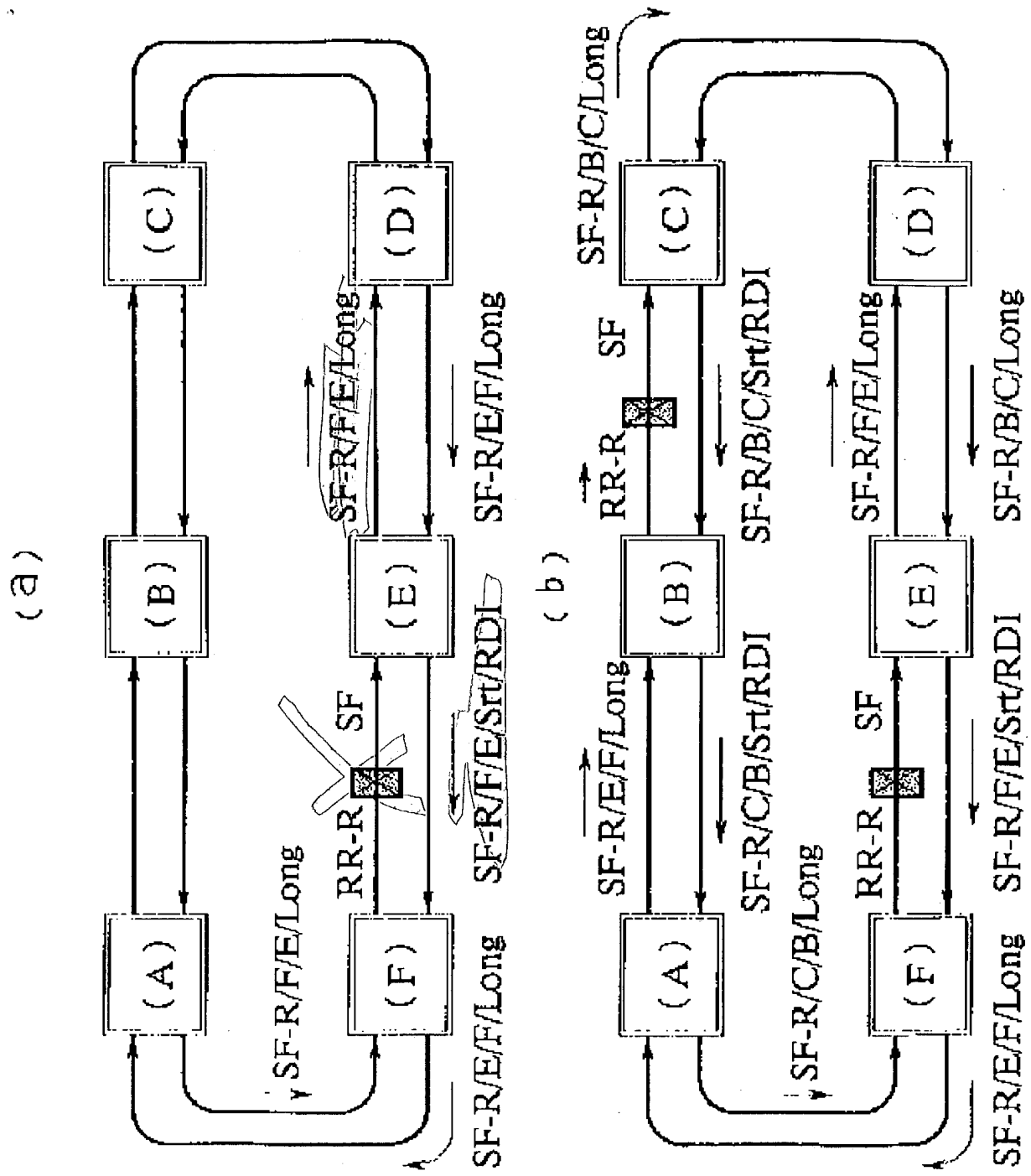
Dwg- 33

スケルチ動作説明図



DRAW 34

単一障害と複数障害との判定説明図



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